10TH EUROPEAN DRY GRASSLAND MEETING

When theory meets practice: Conservation and restoration of grasslands

BOOK OF ABSTRACTS

24 - 31 May 2013

Zamość | Poland

Organizers:
Naturalists' Club (Klub Przyrodników) http://www.kp.org.pl/
European Dry Grassland Group http://www.edgg.org/

Supporting organisations and institutions:
International Association for Vegetation Science (IAVS; www.iavs.org)
LIFE+ Programme (http://ec.europa.eu/environment/life)
National Fund for Environmental Protection and Water Management (www.nfosigw.gov.pl)
Regional Directorate for Environmental Protection in Lublin (http://lublin.rdos.gov.pl/)
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Proofreading:
Dorota Szewczuk

Publisher:
Wydawnictwo Klubu Przyrodników, 1 Maja 22, Świebodzin

Press:
MULTIGRAF S. C., Bielicka 76c, Bydgoszcz

Printed within the framework of LIFE08NAT/PL/000513 „Conservation and restoration of xerothermic grasslands in Poland – theory and practice" project, realized by Naturalist's Club and Regional Directorate for Environmental Protection in Lublin, financed by European Union funding instrument LIFE+ and National Fund for Environmental Protection and Water Management
http://www.murawy-life.kp.org.pl

ISBN:978-83-63426-08-8

PLENARY TALKS

Application of technical grassland restoration in Europe: recovery of grassland biodiversity by seed mixtures at multiple countries and scales

Péter Török

molinia@gmail.com

Department of Ecology, University of Debrecen, H-4010 Debrecen, PO Box 71, Hungary

Sustaining grassland biodiversity is a key element for biodiversity conservation in Europe. In the last century following agricultural intensification both the area and connectivity of grasslands have decreased dramatically. To recover and protect grassland areas restoration actions are often necessary. There are promising examples of grassland restoration actions where the restoration can be based on spontaneous processes but in most cases technical restoration of grasslands is needed. Using technical restoration, a fast recovery of perennial vegetation can be expected which is beneficial for (i) rapid healing of landscape scars, (ii) prevention of soil erosion or (iii) suppression of noxious weeds and invaders. To recover grasslands the most frequently applied technical restoration measure is sowing low to high diversity seed mixtures. Generally, low-diversity seed mixtures contain seeds of 2 to 8 competitor graminoid or forb species, while in high-diversity seed mixtures also seeds of some rare species are included (species numbers ranging generally from 15-30 up to 60). Low-diversity seed mixtures are generally cheap and can be easily compiled and used for large-scale restorations. High diversity seed mixtures are generally more expensive and difficult to compose but higher species richness can be recovered within a short time which is an advantage where spontaneous dispersal is very limited. There are several problems in application of seed mixtures including (i) the sort and proportions of species should be included; (ii) the sowing density, (iii) and the post-restoration management of restored sites. There are marked differences in application circumstances of seed mixtures in different parts of Europe. In some Western European countries there is a developed seed market and seed propagation strategy for the production of seed mixtures of local provenance. In some of the East European countries even the seeds of foundation species are unavailable. In East-Europe large and species rich grassland areas missing from most Western European countries provide good research objects for studying ecosystem functions. It can be concluded that international knowledge transfer is necessary to effectively use technical restoration measure for recovering grassland biodiversity in Europe.

LIFE Nature for dry grasslands: examples and best practices

Simona Bacchereti

sba@aeidl.eu

LIFE Programme Communications Team ASTRALE GEIE – AEIDL, Brussels, Belgium

The LIFE Programme has been the European Union's funding instrument for the environment since its approval in 1992. It is composed of three strands (LIFE Nature and Biodiversity, LIFE Environment Policy and Governance and LIFE Information and Communication).
Since its establishment 21 years ago, the LIFE Nature and Biodiversity component (formerly LIFE Nature), has co-financed a total of 1 348 projects, providing some € 1.2 billion, and mobilising a further € 1.2 billion in other public and private contributions. This continuous source of targeted financing has radically changed the capacity of many countries and regions to care for and manage Natura 2000 sites.
LIFE projects actions are varied and can encompass the development of management plans and other policy documents, support for the enlargement of the Natura 2000 network, improving knowledge of species and habitats, direct conservation actions, capacity building and awareness raising. The results of the first assessment of the conservation status of species and habitats (Article 17 report), which was published in 2010, highlight the importance of LIFE as the sole source of funding for the conservation, restoration and management of certain species and habitats at EU level.
Most LIFE projects targeting habitat restoration have resulted in the sites concerned achieving favourable conservation status.
Grassland ecosystems, with more than 400 projects co-financed, are one of the habitat types that have been most often targeted by LIFE (together with forests and freshwater habitats).
The projects cover almost all grasslands habitats with a particular focus on calcareous and dry grasslands habitats, which were targeted by more than a half of the projects.
Some examples of projects actions on dry grasslands habitats include: steps taken to re-establish traditional farmland activities that support grasslands habitats, elimination of trees, mowing, recovering degraded areas, habitat restoration, alien species eradication, establishment of fences and the reintroduction of grazing.
Several other projects have targeted species that depend on dry grassland habitats, such as invertebrates, birds, reptiles and plants.
This communication will present some examples and best practices from successful LIFE Nature projects targeting grassland ecosystems, and particularly dry grasslands, with the aim to contribute to the active dissemination of the results.

ORAL CONTRIBUTIONS

Trait-based analysis of spontaneous grassland recovery in sandy old-fields

Ágnes-JúliaAlbert[1], András Kelemen[1], Orsolya Valkó[1], Tamás Miglécz[1], Anikó Csecserits[2], Tamás Rédei[2], Balázs Deák[3], Béla Tóthmérész[1], Péter Török[1]

albaranka@yahoo.com

1) University of Debrecen, Department of Ecology, Egyetemtér 1, H-4032 Debrecen, Hungary
2) HAS Centre for Ecological Research, Institute of Ecology and Botany, Alkotmányutca 26, H-2163 Vácrátót, Hungary
3) Hortobágy National Park Directorate, Sumenutca 2, Debrecen H-4024, Hungary

Spontaneous succession is increasingly integrated in grassland restoration projects worldwide. In Central-Europe 10-20% of the croplands is abandoned; thus, spontaneous succession in old-fields is a focal issue in restoration ecology. We studied spontaneous succession in 24 differently aged (<10-year-old; 10-20-year-old and 20-40-year-old) old-fields using the chronosequence method, in Kiskunság (calcareous) and Nyírség (acidic) sand regions in Hungary. Old-field vegetation was compared to target grasslands (open and closed dry sandy grasslands). The percentage cover of vascular plants was recorded in five 2×2-m-sized plots each field, in early May and late June 2012. We used life-forms, clonal spreading traits and Ellenberg indicator values for nutrients during the analysis. Species of Festuco-Brometea class were considered as target species. We aimed to answer the following questions: (i) How do the proportions of different functional groups change during succession? (ii) Which target species establish successfully in the old-fields during the course of succession? (iii) How successful is spontaneous succession in the recovery of target grasslands? We found that the cover of perennials, the cover of hemicryptophytes and geophytes increased in time, while the cover of short-lived species decreased in both regions. The cover of invasive species decreased with increasing field-age. Cover of species without clonal-spreading ability decreased, while covers of the species with clonal-spreading ability increased with the increasing field age. Majority of target species established already in the young and middle-aged old-fields, although their cover was significantly higher in the two older age-groups. The weighted mean of N-values decreased significantly with time in the calcareous region. Spontaneous succession can be a vital option in recovery of sand grassland vegetation in Central-Europe, the majority of the species pool of sandy grasslands can be recovered in the first 10-20 years. However, the success of grassland recovery can be strongly influenced by the surrounding species pool and slow if seed dispersal is limited. The spontaneous succession is most promising when the target species of grasslands immigrate at the very beginning of the succession in the first few years.

The project “Conservation and restoration of xerothermic grasslands in Poland” - preliminary results

Katarzyna Barańska, Michał Żmihorski, Paweł Pluciński, Anna Cwener, Piotr Chmielewski, Katarzyna Kiaszewicz

kasia_baranska@interia.pl

Klub Przyrodników, 1 Maja 22, 66-200 Świebodzin, Poland

In 2010 we started large-scaled project concerning xerothermic grassland conservation in Poland. The experienced gained during realization of particular project tasks let us to draw some conclusions on different methods of xeric grassland conservation. During 2010-2013 we applied several techniques: mobile pasturage, shrub and tree clear-cutting, top soil layer removal, land purchasing and others. Mobile pasturage with the sheep stock of 80 individuals appeared to be difficult, lasts long and expensive but effective - positive transformations of grasslands seem to be visible. Clear-cutting is relatively simple, fast, and cheap but re-growing of cut-off plants, especially Robinia pseudoacacia, is problematic. Removal of top layer of soil in the heavily degenerated grasslands was expensive but gave clear result in the physicochemical context: as a result of the removal pH and CaCO3 increased, while C decreased significantly. Land purchasing appeared to be unpredictable task and difficult because of administrative issues. The preliminary result seem to show that future projects aiming at grassland conservation should be simpler (lower number of particular tasks), and should address the fact that protection of grassland needs long-lasting effort due to regeneration of removed trees and bushes.

Realized within the framework of LIFE08NAT/PL/000513 „Conservation and restoration of xerothermic grasslands in Poland – theory and practice” project, by Naturalist’s Club and Regional Directorate for Environmental Protection in Lublin, financed by European Union funding instrument LIFE+ and National Fund for Environmental Protection and Water Management.

Can grassland stability be inferred from fine-scale spatial patterns?

Sandor Bartha, Klára Virágh, Cecília Komoly

bartha.sandor@okologia.mta.hu

MTA Centre for Ecological Research, Institute of Ecology & Botany, H-2163 Vácrátót, Alkotmány str. 2, Hungary

More diverse ecosystems are expected to be more resilient against perturbations. However, most of the related evidences come from modelling studies and from microcosms experiments, and little is known about the diversity-stability relationships under natural conditions. Our aim was to assess the fine-scale diversity patterns in various natural and degraded communities, to understand adaptation thresholds related to changing climate and land use, and to develop effective indicators for early warning about negative processes. The spatial and temporal variability of natural and disturbed (previously overgrazed then abandoned) stands of loess steppe meadows (dominant species are: *Brachypodium pinnatum, Festuca rupicola*, and *F. pseudovina*) and sand steppes (dominant species are: *Festuca vaginata* and *Stipa borysthenica*) were monitored since 1995. For monitoring we used a standard sampling design - a version of the line-intercept sampling - where presence of plant species is recorded along 52 m long circular belt transects of 1040 units of 5 cm x 5 cm contiguous microquadrats. Various aspects of fine-scale diversity (e.g. structural complexity and spatial dependence) were evaluated by using information theory models. The highest diversity and structural complexity appeared in the loess steppe meadows stands of highest naturalness. Slightly degraded sand steppes showed the lowest diversity and the largest spatio-temporal variability in diversity. Long-term monitoring revealed no trends but fluctuations in most community level attributes and in species composition. Comparing the magnitudes of fluctuations, five times higher relative interannual variability (CV%) was found at the degraded sand steppes. The larger temporal variability found in more arid and more degraded sites suggests larger vulnerability and highlights the importance of studying the thresholds of variability and resilience. Proper land management focusing on maintaining diversity and complexity in grasslands indirectly contributes to the long-term stability and persistence of these vegetation types. Our results imply that diversity and structural complexity are important sources of adaptive behaviour of vegetation and future dynamic behaviour of grasslands can be predicted from snapshot assessments.

Linking elevation and vegetation types in alkali landscapes – Implications for habitat mapping by airborne laser scanning

Balázs Deák[1], W. Mücke[2], A. Schroiff[3], H. Heilmeier[1]

debalazs@gmail.com

1) TU Bergakademie Freiberg, Institutfür Biowissenschaften, Freiberg, Germany
2) Vienna University of Technology, Department of Geodesy and Geoinformation, Research Groups Photogrammetry and Remote Sensing, Vienna, Austria
3) YGGDRASIL Diemer, Berlin, Germany

Pannonic alkali grasslands are one of the best preserved grasslands in Europe, typical for the Pannonian biogeographical region. Alkali grasslands are included in the Natura 2000 network as “Pannonic salt steppes and salt marshes (1530)”. These grasslands harbour several grassland types with very diverse site characteristics regarding their soil salinity, groundwater level and soil organic matter. Adjacent to alkali grasslands, on the top of loess plateaus “Pannonic loess steppic grasslands (6250)” are situated. Alkali and loess grasslands form a very complex and heterogeneous mosaic structure. Vegetation pattern of alkali grasslands is determined by soil salinity and groundwater level. It was shown in former studies that these parameters show a strong correlation with the fine-scale elevation differences. Conventional habitat mapping in such complex landscapes is often very difficult and time-consuming; thus, high-resolution mapping based on remote sensing (RS) techniques is an ideal solution in alkali landscapes. Besides habitat mapping, RS can be also an effective tool for assessing habitat quality and for planning management and restoration actions. The goal of the presented study is to provide a novel methodology for large-scale habitat mapping of alkali landscapes and to predict grassland types based on elevation data detected by airborne laser scanning (ALS). ALS data with an average point density of 25 pts/m² were acquired in March 2012 in Ágota-puszta, Hortobágy National Park (East-Hungary). A high resolution digital terrain model (DTM) with a grid size of 0.25m was derived from the ALS point cloud. Field vegetation surveys for training and validation purposes were carried out at the same time. 18 plots of 50×50m were designated, representing all typical grassland types of the study site. Exploratory data analysis (classification tree) was used to study the correlation between elevation and vegetation types. Decision trees were built for vegetation type classification. We found that the main grassland types (loess grasslands, alkali steppes, open salt grasslands and alkali meadows) could be separated by fine differences in terrain height. In many cases a more detailed distinction was also possible between different types of alkali meadows (Agrostio – Alopecuretumpratensis or Agrostio – Glycerietumfluitantis) or between primary and secondary alkali steppes.

Should grazing be re-introduced in Hungarian dry grasslands?

László Erdös[1], Dániel Cserhalmi[2], ZoltánBátori[1], Tamás Morschhauser[3], Andrea Dénes[4]

erdos.laszlo@bio.u-szeged.hu

1) Department of Ecology, University of Szeged, Szeged, Hungary
2) Department of Botany, Szent István University, Budapest, Hungary
3) Department of Plant Taxonomy and Geobotany, University of Pécs, Pécs, Hungary
4) Department of Natural History, Janus Pannonius Museum, Pécs, Hungary

Apart from habitat destruction, shrub encroachment is regarded as a major threat to grasslands, contributing to the loss of grasslands worldwide. In the Carpathian Basin, natural dry grasslands play an extremely important role from a nature conservation perspective. Correct management of the grasslands is essential if high diversity is to be maintained. In this study, our aim was to provide information that can support conservation decisions.
First, we quantified the speed of shrub encroachment in a xeric forest-grassland mosaic landscape of a nature reserve (Mt Szársomlyó). For this purpose, we compared aerial photographs from the years 1964, 1984 and 2005, and determined the proportion of woody vs. non-woody vegetation. Moreover, we analysed two nearby, similar areas (Mt Tenkes and Mt Tubes), where grazing caesed earlier. In addition, we revealed the land-use history of the study areas using old maps, historical documents, travel reports and diaries, botanical data, etymology of the local geographical names, interviews with local inhabitants and our own observations. Finally, we made a comparison with two other types of Hungarian grasslands: sandy grasslands and salt steppes.
We found that the proportion of woody vegetation on Mt Szársomlyó was 9.83% in 1964. This increased to 21.7% by 2005. Traditional management of the site was grazing from at least the 11th century BC. Although grazing intensity most probably fluctuated as a consequence of changing human population density, it was more or less continuous till the 1970's, when grazing was abandoned. When our results were compared to the two nearby areas, we found that the earlier the grazing ceased, the smaller the proportion of the remaining grassland was. In the case of Mt Tubes, where grazing stopped around 1890, the proportion of forests was 96.41%. Our results suggest that grazing should be regarded as a potential tool to maintain the extremely high level of biodiversity of the study region.
Sandy grasslands and salt steppes are somewhat different. In the case of the former, proportion of forests and grasslands usually does not change very much through time. The overwhelming majority of salt steppes are mown in Hungary. However, as indicated by our detailed botanical surveys, a moderate level of grazing would be more appropriate from a nature conservation point of view.

Environmental and management drivers of vascular plant diversity in semi-natural dry grasslands in relation to vegetation dynamics

Eleonora Giarrizzo, Sabina Burrascano, Laura Zavattero, Carlo Blasi

eleonora.giarrizzo@gmail.com

Departament of Environmental Biology, Sapienza University, Piazzale Aldo Moro 5, 00185 Rome, Italy

Semi-natural grasslands are among the most diverse ecosystems in Europe; indeed several of these grassland types are recognized as priority habitats in the European Directive 92/43/CEE. During the last decades, in Europe, the abandonment of traditional agricultural practices, especially in mountain regions, caused severe reduction of the extent of semi-natural grasslands, since their maintenance depends on active extensive management. This trend was confirmed also for Italy especially for the Apennine chain where grasslands halved their extent in 40 years.

We focused on plant communities included in the Directive Habitat 6210 (Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)), since they are among the most spread and the most diverse semi-natural grassland types in Southern Europe.

We aim at assessing to what extent semi-natural dry grasslands included in the Habitat 6210 were subject to variation in vascular plant species composition, and at defining the main drivers of such variation. We also aim at assessing if the observed changes in composition determine shifts in: i) species diversity; ii) species functional traits.

The study approach is based on a multi-temporal analysis of phytosociological relevés. We selected published relevés performed between 45 and 15 years ago associated to detailed vegetation maps. The spatial information on published relevés will allow to compare them to new relevés that will be performed in sites as close as possible to the original sites. Environmental (climatic, topographic and soil) and management data (past and current grazing intensity) will be recorded to identify the drivers of changes in plant species composition. In order to assess if shifts in diversity levels occurred, fixed-area floristic sampling will be carried out. Finally the functional traits of the diagnostic species of the sampled communities will be measured in order to explore variations in the ecological characteristics of the communities.

This project will be carried out in at least five study areas along the Apennine chain. We present it here at its very beginning since we would like to widen our perspective to Southern Europe through collaborations within the European Dry Grasslands Group.

Priority actions for dry grasslands in Southern Belgium

Sandrine Godefroid[1], Marc Ameels[2], StéphaneBocca[3], David Doucet [3], Joëlle Huysecom[3], Xavier Janssens[3], Jean-Luc Mairesse[3], Séverin Pierret4, Fabienne Van Rossum[1], Bernard Vandoren[2], Patrick Verté[4]

sandrine.godefroid@br.fgov.be

1) National Botanic Garden of Belgium, Nieuwelaan 38 1860 Meise, Belgium
2) Service Public de Wallonie, Département de la Nature et des Forêts, Route de l'Eau Rouge 11, 4970 Stavelot, Belgium
3) Réserves Naturelles RNOB Natagora, Wisconsin 3, 5000 Namur, Belgium
4) Service Public de Wallonie, Département de l'étude du Milieu Naturel et Agricole, Avenue Maréchal Juin 23, 5030 Gembloux, Belgium

As in many European countries, grassland habitats and several of their characteristic species are in critical conditions in Belgium. Main reasons for this situation are habitat fragmentation, abandonment of the traditional agro-pastoral activities and intensification of agricultural practices. There is therefore an urgent need to preserve, manage and restore the remaining, often degraded, habitat patches, but also to actively restore populations of critically endangered plant species. A new LIFE project has recently started in Southern Belgium (LIFE11 NAT/BE/001060). It will last 7 years (2013-2019) and aims to improve the conservation status of 400 ha of priority grasslands. LIFE funds will be used to support 11 different grasslands types, including six priority habitats, among which xeric sand calcareous grasslands (6120*), semi-natural dry grasslands on calcareous substrates (6210*) and species-rich Nardus grasslands (6230*). Conservation work will involve increasing the surface area of these habitats. This will be achieved by improving the functionality of the project areas' ecological network.
This talk will present the context of the project and explain the different actions for:
- Improving the conservation status of the grassland habitats (quantity and quality of the target habitats will increase over a total area of 400 ha);
- Preventing the extinction of the habitats' characteristic species, especially those that are most vulnerable to fragmentation, by population reinforcements/reintroductions after the restoration of their habitat. Targeted species are *Dianthus deltoides, Petrorhagia prolifera, Helichrysum arenarium, Campanula glomerata, Antennaria dioica* and *Arnica montana*.
- Improving the efficiency and effectiveness of the implemented restoration actions by enhancing the state of knowledge on the distribution of habitats and their typical species, by assessing conservation priorities in the project area, and by better training of stakeholders;
- Improving the ecological connectivity of grasslands in and between the Natura 2000 network sites through the use of habitat 'stepping stones' and 'corridors'.
Methods used for the restoration of the habitats involve: land purchase (250 ha); restoration of ecological corridors and stepping-stone sites; logging site preparation; population reintroduction and reinforcements by transplantations of young plants of the target species and seed sowing; mowing; grazing; implementing a monitoring system.

Relevance of surrounding landscape for alpha diversity of dry grasslands

Monika Janisova[1], Dana Michalcová[2]

monika.janisova@gmail.com

1) Institute of Botany, Slovak Academy of Science, Dumbierska 1, 974-11, Banska Bystrica, Slovakia
2) Department of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic

In our contribution, we tried to answer the following questions: i) How is plant alpha diversity of dry grasslands affected by the structure of surrounding landscape? ii) Can surrounding habitats affect species composition of dry grasslands? Species data were extracted from Slovak vegetation plot database. Surrounding land-use (in terms of cover and diversity of various habitats in plot neighbourhood) was derived from CORINE land cover maps and National Grassland Inventory. Along with total number of species in vegetation plots we considered number of target grassland species and number of species typical of forest and non-natural habitats (including alien species). Simple linear and quadratic regression models and regression tree analysis were used to examine the relationships between alpha diversity and studied landscape factors. Moreover, the relationship between alpha diversity and landscape structure in dry grasslands was compared to other grassland types (i.e. semi-dry, mesic and wet).

Our analysis revealed that alpha diversity of dry grasslands was not so strongly influenced by landscape structure as in semi-dry and mesic types, although a subtle increase of species number with increasing proportion of both semi-natural and non-natural habitats was observed here. In the case of (semi)natural habitats, most of grassland species were supplied from valuable grasslands. The number, proportion and cover of forest species in dry grassland plots were not positively related to proportion of forest habitats in plot neighbourhood. Proportion of archaeophytes (but not neophytes) and species typical of non-natural habitats increased with increasing proportion of non-natural (agricultural and artificial) habitats in their neighbourhood.

Conclusion: Both (semi)natural and non-natural habitats may serve as species sources and contribute to alpha diversity of dry grasslands. Dry grasslands surrounded by high proportion of other valuable grasslands had the highest alpha diversity of target species. These results emphasize the important role of size and connectivity of dry grassland patches in conservation of dry grasslands.
Financial support: VEGA 2/0099/13.

Molecular ecology and conservation genetics of the weevil *Centricnemus leucogrammus* (Insecta: Coleoptera)

Łukasz Kajtoch[1], Daniel Kubisz[1], Miłosz A. Mazur[2], Wiesław Babik[3]

lukaszkajtoch@poczta.fm

1) Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland
2) Center for Biodiversity Studies, Department of Biosystematics, Opole University, Poland
3) Institute of Environmental Sciences, Jagiellonian University, Cracow, Poland

Xerothermic environments are extrazonal analogs of Eurasian steppes. Their distribution in Europe is presently highly fragmented and limited to “warm-stage” refugia. Xerothermic habitats are highly threatened and mostly protected under international and local laws. However, the knowledge about origin, population structure and ecology of xerothermic species is still insufficient. The weevil *Centricnemus leucogrammus* has been chosen as a model species for the assemblages of steppic beetle as it is stenotopic to steppe-like habitats, flightless, polyphagous and occurs in most of suitable areas. Analyses of mitochondrial genes have shown that all studied regional groups of populations (S Poland, Kujawy region, W Ukraine and Moravia-Slovakia) are distinct and migration in the recent past might have occurred only among S Poland and W Ukraine. Similarly, the analysis of microsatellite variation demonstrated distinctiveness of all regions, with substantial genetic structuring observed also within regions. This particularly concerns highly isolated populations from the Kujawy. These findings suggest persistence of the studied weevil populations in situ for a long period of time during the Pleistocene. On the other hand, both mtDNA and microsatellites suggest that migration within S Polish and within Ukrainian populations is still occurring or occurred until recently. Effective population sizes estimated for individual localities were very low, around 5-20 individuals. Molecular barcoding of host plants from all four main regional groups of populations showed that this species is highly polyphagous and feeds on at least 23 plant genera from 7 families (Rubiaceae, Ranunculaceae, Lamiaceae, Asteraceae, Rosaceae, Fabaceae, Apiaceae). Composition of host plants from each region was substantially different. All data collected so far strongly suggest that all regional groups of *C. leucogrammus* populations are significantly distinct and isolated. This leads to the conclusion that they should be considered as independent conservation units. On the other hand gene flow detected between localities within S Polish and Ukrainian population groups suggests recent connectivity among xerothermic turfs in those area. This could be important information for the protection of xerothermic habitats and restoration planning. *C. leucogrammus* could be an excellent species for monitoring quality and connectivity of xerothermic habitats.

Vegetation recovery and management of abandoned sheep corrals in semi-arid grasslands

Jaime Kigel[1], A. Vinograd[1], E. Zaady[2]

kigel@agri.huji.ac.il

1) Faculty of Agriculture, Hebrew University of Jerusalem, Israel
2) Volcani Institute, Agricultural Research Organization, Ministry of Agriculture, Israel

Extensive areas in the semi-arid belt of Israel are under intensive multipurpose use, providing diverse benefits, but with potential conflicts of interests among different users - grazers, foresters, conservationists and tourists. The region has a typical Mediterranean climate, with mild rainy winters, and hot dry summers. The herbaceous vegetation is highly diverse, rich in geophytes and with strong dominance of annual species. These areas are partly afforested, requiring grazing to reduce the risk of fire during the dry season. Grazing is seasonal during winter and spring, performed by flocks of sheep and goats, and is part of an annual cycle including grazing in harvested cereal fields, thus increasing farmer's income. Grazing is also required for conservation purposes since, by reducing the herbaceous vegetation, persistency of less competitive attractive geophytes in the landscape is improved (e.g. *Anemone coronaria*). Flower carpets during the flowering season attract large numbers of visitors, with a significant income for the local population. On the other hand, sheep grazing negatively affects the productivity of the ecosystem. Deposition of feces and urine in the corrals depletes the range from soil resources, thus reducing biomass production for grazing. After the corrals are abandoned, dense nitrophilic vegetation develops in the corrals including a high cover of thistles. These patches of undesirable and unpalatable vegetation persist for 15-20 years and reduce the aesthetic value of the landscape. Here we analyzed the dynamics of vegetation recovery in abandoned corrals, land management practices for restoration of the vegetation and the conservation of valuable species in the landscape.

Dry grassland vegetation of Central Podolia (Ukraine) – first insights on syntaxonomy, ecology, and biodiversity

Anna Kuzemko[1], Ioana Ardelean[2], Thomas Becker[3], Michael Jeschke[3],Ute Becker[4], Monica Beldean[2], Yakiv Didukh[5], Christian Dolnik[6], Alireza Naqinezhad[7], Emin Uğurlu[8], Aslan Ünal[9], KirilVassilev[10], EugenyVorona[11], OlenaYavorska[11], Jürgen Dengler[12]

anya_meadow@mail.ru

1) National Dendrological Park Sofiyvka, National Academy of Science of Ukraine
Kyivska str. 12a, 20300 Uman, Ukraine
2) Babeş-Bolyai University Cluj-Napoca, Republicii str. 44, 400015 Cluj-Napoca, Romania
3) University of Trier, Behring str. 21, 54296 Trier, Germany
4) Johannes Gutenberg-Universität Mainz, Anselm-Franz-von-Bentzelweg 9b, D 55099 Mainz, Germany
5) M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, Tereschenkivska str. 2, 01601 Kyiv, Ukraine
6) Institute for Natural Resource Conservation, Ecology Centre, University of Kiel, Olshausen str. 40, 24098 Kiel, Germany
7) University of Mazandaran, Babolsar, P.O. Box 47416-95447, Mazandaran, Iran
8) Celal Bayar University, Muradiye, Yağcilar Campus, 45140 Manisa, Turkey
9) 584 Salzstr.37, 585 D-79098 Freiburg, Germany
10) Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Acad G. Bonchev str., bl. 2, 1113 Sofia, Bulgaria
11) Vinnitsya Regional Ecological Association “Green World of Podillya”, Pershotravneva str. 70/2, 21050 Vinnitsya, Ukraine
12) University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany

Ukraine is situated between Western and Central Europe on the one hand, and the former Soviet Union on the other, where the vegetation classification developed to a certain degree in isolation from each other, resulting in the appearance of a number of controversial issues, which are impossible to solve at the level of a country without close international cooperation.

Based on these considerations, the European Dry Grassland Group (EDGG; www.edgg.org) decided to conduct the second EDGG Research Expedition in Ukraine in 2010. When choosing a model area for the study, we were guided by the following criteria: i) it had to be a region with a high diversity of dry grasslands, caused by a variety of environmental conditions with ii) a predominance of natural grassland on the secondary ones, from which iii) hardly any phytosociological data were available before. The territory of the Central Podolia fully met these criteria.

We sampled the types of dry semi-natural grasslands occurring in the area with two approaches, always including all vascular plants, bryophytes and lichens. On the one hand we applied nested-plot series of 100 m² with subplots of 0.0001, 0.001, 0.01, 0.1, 1 and 10

m², on the other hand we made classical phytosociological relevés on 10 m² including the sampling/measurement of a wide range of structural, soil and other environmental variables. Based on the 10-m² plots, we could distinguish nine communities that seem to warrant the rank of association and belong to two classes (Festuco-Brometea and Koelerio-Corynephoretea). We describe their floristic composition and their characteristics in terms of structure, biodiversity and environmental condition, and discuss their placement in the European phytosociological system. Furthermore, we will present the diversity patterns of all taxonomic groups at the different spatial scales studied.

Orthoptera life forms as indicators of grassland quality

Rocco Labadessa[1], Mirella Benedetta Campochiaro[2,3], GrazianaAntolino[3], Luigi Forte[1,3], Paola Mairota[2]

rlab@libero.it

1) Department of Biology, University of Bari, Via Orabona 4, 70125 Bari, Italy
2) Department of Agro-Environmental and Territorial Sciences, University of Bari, Via Orabona 4, 70125 Bari, Italy
3) Botanic Garden and Museum of the University of Bari, Via Orabona 4, 70125 Bari, Italy

Grasshoppers (Orthoptera) are well known to represent the majority of insect biomass in many grassland ecosystems. However, the verification of a relation between grasshoppers community structure descriptors and those used for plant community is not straightforward.
We explore the usefulness of the concept of life forms to provide insights on such ecosystem level relationship. For this purpose, surveys were performed within 30 linear 80m transects in Alta Murgia National Park (southern Italy), recording abundance/dominance for each Orthoptera and herbaceous plant species during March-September 2012. Plants were classified according to life forms, chorotypes and role within syntaxa of conservation value. For grasshoppers the Bei-Bienko classification of life forms was adopted, as it is based on their specific selection for grassland herb layers. Species richness and abundance of each functional group were estimated and used to calculate the overall Shannon´s H´ diversity and the life form H' diversity index. The relations between the variables thus obtained were tested by means of bivariate correlation analysis.
As expected, while overall grasshopper indexes of richness, abundance and diversity show generic relations with plant community descriptors, those relevant to the life-form classification seem more informative. Some grasshopper groups (Thamnobionta and Chortobionta) show significant relations with plant community variables representing grassland quality indicators, e.g., plant life-form diversity, abundance of chamaephytes and characteristic species of protected endemic grasslands. Geo-Chortobionta, representing the bulk and the more generalist portion of Orthoptera communities, are associated to plant communities richer in geophytes and Steno-Mediterranean chorotypes, while Geobionta species are related to xeric annual communities, less characterised by chamaephytes and perennial mesic species. The H' diversity value of Orthoptera life forms is higher for tall grass communities, possibly indicating a positive relation with well structured grasslands.
These results demonstrate the potential value of life form classification in diversity studies to inform on the role of each grasshopper group within community and ecosystem, providing inferences about grassland habitat structure and quality. Such inferences are useful to the definition of local conservation actions as well as for habitat monitoring purposes also including remote sensing techniques.

Indoor germination experiment confirms field evidences - Litter is crucial in suppression of weed seedling establishment in grassland restoration

Tamás Miglécz, Péter Török, OrsolyaValkó, András Kelemen, KatalinTóth, Béla Tóthmérész

tamas.miglecz@gmail.com

Department of Ecology, University of Debrecen, Egyetemtér 1, H-4032 Debrecen, Hungary

Litter is crucial to suppressing noxious weeds in the early stages of grassland restoration. Litter accumulation leads to decreased availability of open surfaces, which is essential for the germination of short lived weed species. Experiences gained from field studies support these expectations; however, validation of these results by controlled germination experiments are still missing. Our goal was to test the functional importance of litter in weed suppression both in an indoor germination experiment and in a field study. In the indoor germination experiment we explored the effects of increasing litter cover on seedling establishment of six short-lived Brassicaceae species with different seed masses. Small-seeded species were negatively affected by thick litter layers. In contrast, no negative litter effect was detected for large-seeded species. No overall positive litter effect was found, although the detected seedling numbers for most of the sown species was not the highest at the bare soil pots. Our results suggest that the negative effects of litter are less feasible on the large-seeded short-lived species than on small-seeded ones. In the second study we studied the effectiveness of low diversity seed sowing and hay-transfer in weed suppression and recovery of perennial grassland vegetation in Hortobágy Puszta, East-Hungary. The joint application of the used methods is rare, although it has the potential to gain a directed vegetation development with effective early weed suppression. We found that the additional application of hay significantly accelerated the development of perennial grassland vegetation and provided a higher weed suppression rate in the first year and onwards than seed sowing only. A higher establishment rate was detected both in the cover and the biomass of perennial grasses including Festuca species in all plots with hay addition than with sowing only. Our results suggest that the combination of hay transfer and low diversity seed sowing may provide a cost-effective alternative to the more costly high-density sowing and if proper sources for high-diversity hay are available, it may replace high-diversity seed mixtures. According to our findings germination of weeds under litter cover is seed size dependent, but the targeted grassland species are not hampered by litter cover.

Fire in steppe reserves: to burn or not to burn? A response of spider community to prescribed and spontaneous burning

Nina Polchaniova

polchaninova@mail.ru

V. N. Karazin Kharkiv National University, Svobody sq. 4, Kharkiv, 61022, Ukraine

Traditionally, two main conservation management types are being used in Ukrainian steppe reserves: strict protection and mowing. Prescribed burning as a protective measure has not been implemented till present. Fire is considered to be a natural factor which prevents tree and shrub penetration and extra plant debris accumulation in steppe habitats that, in turn, results in change of moisture and temperature conditions and possible degradation of steppe community. However, the impact of fire on the steppe biota is ambiguous. Different species respond to fire in different ways, beneficially or negatively. Post fire changes of invertebrate community are especially poorly understood.

Spider complexes of the steppe biome are abundant and diverse. Spiders inhabit all vegetation layers, have a high dispersal capacity and lead different ways of life. Thus, they can serve as a model for monitoring the post fire recovery of different ecological groups of invertebrates.

We studied a case of spontaneous summer fire resulting in a complete burn of the protected area and two cases of prescribed spring and autumn patched burning in the forb-bunchgrass steppes of eastern Ukraine.

Herb-dwelling spiders begin to settle the sites of fire in July, when spidlings of a new generation begin dispersing. In September the araneocomplex structure becomes similar to that of intact steppe, and in two-three years it recovers completely.

Cursorial spiders appear in burned steppe soon after the fire. In the first year, spider community decreases in species richness and increases in dynamic density; dominance structure changes dramatically in favor of one or two generalist species. In the third year both species diversity and number increase significantly and grow higher than in unburned plots. Sites of fire attract xerophilous species which usually do not occur in dense vegetation of forb steppes. In case of frequent burning spider diversity declines.

Epigeic spiders, which live in litter and do not move fast, turn out to be extremely vulnerable. During three years after the fire, their number and diversity did not recover. They were represented by singletons, some rare species with mosaic geographic distribution disappeared from the local fauna. Such a reaction of endangered species is the main restriction on the use of fire as a conservation management. The prerequisite of its implementation is maintaining relevant refuges for threatened species.

Conservation of dry grassland and grey dune habitats of EU importance in Latvia

Solvita Rusina[1], Baiba Strazdiņa[2], Brigita Laime[3], Anita Namatēva[3], Agnese Priede[3]

rusina@lu.lv

1) University of Latvia, Raiņa bulvāris 19, Riga, LV-1050, Latvia
2) Latvian Fund for Nature, 73-2 Dzirnavu Street, Riga, LV 101, Latvia
3) Nature Conservation Agency, 7 Baznīcas Street , Sigulda, LV 2150, Latvia

The aim of the present research was to assess the conservation status of dry grassland and grey dune habitats and to analyse the impact of Rural Development Programme on conservation of dry grassland habitats and Life Nature projects on conservation of grey dune habitats.
In Latvia, all dry semi-natural grassland and grey dune vegetation types belong to habitat types listed in 92/43/EEK Habitats Directive, they are 2130*, 2140*, 2170, 2330, 5130, 6110*, 6120*, and 6210.
Dry grassland and scrub habitats cover approx. 4100 ha (8 % of all semi-natural grasslands). Only 56 % of this area are located inside Natura 2000 sites. Grey dune cover 1500 ha and the most diverse areas (50 %) of them are inside Natura 2000.
To analyse management of dry grassland habitats official data of Rural Support Service of the Ministry of Agriculture, and Nature Protection Agency were used. Grassland management is supported through agro-environmental schemes under the activity Maintaining Biodiversity in Grasslands. Analysis of conservation status was based on the first results of Natura 2000 site monitoring (2006-2012), four indicators were analysed for grassland habitats – cover of litter layer, cover of shrubs, cover of aggressive species untypical for particular grassland habitat type, and information on management.
During the past 20 years the area of grey dunes in Latvia has decreased due to residential and tourism infrastructure development. Furthermore loss of traditional land management is causing overgrowth with native shrubs, trees and expansive or invasive plant species. Succession to dune woodland leads to loss of bare sand patches, species diversity and decreasing landscape heterogeneity.
The first Natura 2000 monitoring results contradict the data obtained from Rural Support Service. The latter's data indicate that 40-50 % of all eligible grasslands of 6120*and 6210, 28 % of 5130, and 6 % of 6110* are managed under agro-environment scheme Maintaining Biodiversity in Grasslands. Natura 2000 monitoring data show that only 15-20 % of monitored dry grassland sites were managed, and 70-87% of all grasslands experienced dominance of untypical species (e.g. *Calamagrostis epigeios*, *Elytrigia repens, Chaerophyllum aromaticum* etc. aggressive ruderal species) and dense litter layer.
Possible reasons (monitoring methods and used indicators, eligibility of dry grasslands for support under agro-environmental schemes) will be discussed in detail.

Agricultural intensification and fragmentation interactively affect insect communities of calcareous grasslands

Verena Rösch, Teja Tscharntke, Christoph Scherber, Péter Batáry

verena.roesch@agr.uni-goettingen.de

Georg-August-Universität Göttingen, Grisebach str 6, 37077 Göttingen, Germany

Calcareous grasslands are among the most species rich habitats in Europe, but are increasingly threatened due to abandonment and fragmentation. Little is known about how the surrounding landscape influences fragmentation effects. We aimed to investigate the impacts of decreasing fragment size, decreasing landscape complexity and increasing isolation on leafhoppers of calcareous grassland fragments in central Germany.

We selected 14 small and 14 large fragments of calcareous grassland in central Germany, differing in isolation from other calcareous grasslands and in the composition of the surrounding landscape. Leafhoppers, sampled by sweep netting, were either specialists that depended on calcareous grasslands or generalists that could use the landscape matrix, but still required low-productivity habitats.

We recorded 77 leafhopper species with more than 7000 adult specimens (ranging from 14 to 32 species per fragment). Increasing habitat isolation reduced leafhopper species richness in simple (dominated by arable crops), but not in complex landscapes. This effect was driven by the generalist species. In simple landscapes, leafhoppers may find it more difficult to reach the next suitable fragment due to a lack of alternative resources during dispersal.

Furthermore, habitat isolation negatively affected generalist species richness in small, but not in large fragments. In small fragments a higher extinction rate combined with a lower probability of recolonisation through increasing isolation is thought to cause the reduced species richness.

Our results show for the first time that insect species richness can be negatively affected by increasing habitat isolation in simplified but not in complex landscapes, and in small but not in large fragments. Mitigating the negative effects of habitat fragmentation therefore needs to take the surrounding landscape into account. Management efforts should prioritise (i) an increase in connectivity of small, isolated fragments, (ii) an increase in connectivity of fragments in simple landscapes and (iii) enhance dispersal by increasing heterogeneity of both landscape composition and configuration. Moreover, extensive management of fragments by grazing or mowing to increase local habitat quality for leafhoppers would benefit other insect groups as well.

Investigations on the migration of target species from semi dry grassland (Cirsio pannonici-Brometum) to former cultivated fields in Sankt Anna am Aigen (SE Austria)

Philipp Sengl, Martin Magnes

nwsephi@gmx.at

Institute for Plant Science, University of Graz, Holteigasse 6, A-8010 Graz, Austria

The issue of this study was to investigate the colonization process of target species (frequency > 62.5% in the Cirsiopannonici-Brometum) from the semi dry grassland sites to bordering restoration sites. Correlations between colonization success, abiotic site parameters and plant traits were searched for.
The investigated area is located in the southeastern alpine foreland of Austria near the community of Sankt Anna am Aigen (46.81 N/15.98 E- 46.81 N/15.99 E; 281 - 297 m a.s.l.). The soils are non calcaric Cambisol, Stagnosol and calcaric Leptosol. The annual precipitation is between 831.4 – 841.2 mm and the annual average temperature is between 9.1 – 9.3°C (1971-2000).
The study comprises two semi dry grassland sites (Cirsiopannonici-Brometum) which are mowed regularly once or twice per year and two adjacent former cultivated fields (*Zea mays, Malus domestica*). These fields are object of a restoration project since 2009. The restoration measures include mowing once a year with removal of biomass. No further restoration methods with artificial seed dispersal where applied because of the beneficial location directly next to the semi dry grassland sites.
Besides sampling the vegetation (Braun-Blanquet approach, 16 m2) along seven transects, starting within the Cirsiopannonici-Brometum into the restoration sites, we analysed soil parameters (K, P, pH) and recorded the distance each of the samples in the restoration area to the nearest boundary of semi dry grassland.
We searched for target species which could colonize the restoration sites within three years and tested if colonization success was correlated to one of the measured abiotic parameters (soil, distance). Additionally we tried to use plant traits to explain colonization success. The applied analysis methods include DCA and statistical evaluations of all sampled parameters.
In three years since initiation of the restoration project the distance was positively correlated with migration success of target species in the former *Zea mays* field but not in the former *Malus domestica* orchard. There were no significant differences between all the samples with a greater distance than 12m to semi dry grassland. As the most important plant traits for migration success seed weight, ecological strategy type and length of flowering period were determined. The measured soil parameters as well as several supplementary investigated plant traits showed weak or no correlation with the migration success.

A thematic Action Plan related to the conservation of agro pastoral biodiversity through the rationalization of grazing pressure for Aegean island, Skyros, Greece

Michael Vrahnakis[1], Fotiadis George[2], Kleftoyanni Vassiliki[3], Nasiakou Stamatia[1]

mvrahnak@teilar.gr

1) Department of Forestry and Management of Natural Environment, Technological Educational Institute of Larissa, Branch of Karditsa, GR-43100, Karditsa, Greece
2) Department of Forestry and Management of Natural Environment, Technological Educational Institute of Kavala, Greece
3) Nature Conservation Consultants, Gythioustr 4, 15231 Chalandri, Greece

The natural environment and landscape of Skyros island (20,700 ha) located at Sporades complex (north-western Aegean sea) is severely impacted and shaped by livestock overgrazing. Vegetation is dominated by floristic elements of phrygana and maquis, typical of Aegean islands. The long term use of vegetation by livestock (more than 36,000 sheep and goats), combined with wildfires and aridness, resulted in denudation of vegetation, acceleration of erosion, and the domination of skeletal, rocky formations. Moreover, important floristic elements, endemic or typical of the habitat types (92/43/EEC) of the island are susceptible to loss. Twenty (20) out of the sixty (60) endemics of Sporades complex is located in Skyros; the majority of them are highly affected by grazing. Populations of local endemics, growing in road edges are affected by trampling (e.g. *Aubrieta scyria*), others growing inside assemblages of *Quercus coccifera* or *Acer sempervirens* are affected by penetration of grazing (this is the case of *Galanthus ikariae* ssp. *snogerupii*), or chasmophytes like the rare *Aethionema retsina* and *Scorzonera scyria* are especially affected by goat grazing sparse vegetation on rocky seashores. In addition, important faunal elements are also affected by livestock grazing, like the local endemic pony of Skyros *Equus caballus* ssp. *skyriano*. Having as main objective the demonstration of the feasibility of the revitalization of the traditional island land use model in order to sustain high levels of environmental quality the LIFE09NAT/GR/000323, namely "Demonstration of the Biodiversity Action Planning approach, to benefit local biodiversity on an Aegean island, Skyros", was launched in 2010. The present study conducted in the framework of this LIFE project, and aimed at the organization of the extensified livestock husbandry in Skyros island in a rational, environmental-friendly basis, by placing emphasis on the support of traditional practices and the enhancement of biodiversity. The study proposed eight actions, ranging from active management (e.g. it was suggested the 28.6% reduction of livestock capital) up to institutional changes (like the re-activation of farmers' coopearative). In addition, demonstration management was planned for three (3) pilot farms, and specific measures to improve the habitat and the conditions for the pony of Skyros were proposed.

Importance of closed landfills as dry grassland in urbanized areas: Ecological assessment using carabid beetles

Yuno Do, Gea-JaeJoo

doy@pusan.ac.kr

Department of Biological Sciences, Pusan National , Jangjeon-dong, Gumjeong-gu, 609-735 Busan, South Korea

In closed landfill, we investigated the diversity and ecological characters of carabid beetles to understand the ecological importance of closed landfills that have the potential as a multi-functional habitat for improving biodiversity in urbanized area. In addition, we study the influence of environmental factors (vegetation structure, soil) on distribution and diversity of carabid beetles. A total of 92,495 individuals representing 15 carabid species were collected from the closed landfill. Although the species richness of carabid beetles recorded in closed landfill was not higher than the other green spaces in the city, closed landfill could sufficiently provide a stable habitat as a semi-natural area for carabid beetles. Soil pH, Na, and tall grass plant cover influenced carabid assemblage in closed landfill. However, other environmental variables (e.g., K , Na , Mg2 , bare land cover, weedy cover, and tree cover) were not correlated with carabid species composition. It is implied that in closed landfill that is a highly engineered environment modified, other abiotic environmental (e.g., drainage, soil texture, leachate, and landscape context, etc.) and biotic factors (e.g., intra-and interspecific competition) may have affected carabid assemblage. Although the artificial drainages are essential facilities for landfill management, they are a critical factor that affects the species inhabiting the landfill. However, carabid beetles seemed to randomly fall into the artificial drainage. For successful management of closed landfills, it is very important to minimize the intervention and to develop the ecological sensitively management method.

Necessity of protection of original flora and fauna of East Ukraine steppes

Victor Tokarsky

v.tokarsky@mail.ru

V. N. Karazin Kharkiv National University, Svobody sq. 4, Kharkiv, 61077, Ukraine

Steppe, being the most transformed natural zone of Ukraine, occupies 40% of its area. No more than 3-5% of the territory has remained in the natural state. And only less than 1% of virgin areas have been included in the network of objects of the Nature Conservation Fund.
Despite the great efforts of scientific association, degradation of environment, caused by intensive human economic activities, continues to destroy natural ecosystems, which results in the decrease of number or disappearance of many species of animals. In East Ukraine fauna some mammal species such as beaver, marmot, badger, steppe polecat, marbled polecat, great jerboa used to be common. At the end of 20th century many of them were absent. Many species which were called pests have been also disappeared, such as the ground squirrel and common hamster.
Area of nature protection territories of forbs-fescue-feather grass steppes in Kharkiv region comprises 7642,9 hectares (within regional landscape parks “Pechenizhan field” and “Velikoburlukskiy steppe” located here). We have the task to organize yet another nature reserve for steppes conservation – Natural steppe park «Skhidnyy steppe» in Volchansk, VelikiyBurluk and Chuguev districts of Kharkov region, of about 10 thousand hectares. Vegetation reflects the characteristics of steppes of this region. Meadow steppes of the central part of Leftbank Forest Steppe and real steppes of the extreme eastern part of Ukraine (Middle-Russian Forest Steppe subprovince) with considerable participation of groups of low steppe bushes and feather grasses are combined in it.
Vegetation of chalk outcrops is represented by great number of obligate chalk grassland endemics and relict species which sometimes form rare groups. Lately, in connection with steady reduction of steppes areas at chalk outcrops, the issue is increasingly raised about necessity of protection of original chalk flora. On the basis of study of vegetation of the Oskol river valley in which typical for this region flora is well remained, we organized National Natural Park «Dvorichanskiy», with the area of 3131,2 hectares, at the territory of Dvorichna district of the Kharkiv region. Currently, work is underway to expand it to 10 hectares. Looking forward, there are plans to create bilateral nature preserve on the border of Ukraine and Russia in the Oskol river valley. Preliminary works in this direction have already begun.

Semi-natural grassland communities in the western Ukrainian Carpathians

Škodová I.[1], Janišová M.[1], Hegedušová K.[1], Borsukiewicz L.[2], Smatanová J.[3], Kish R.[4], Píš V.[5]

[1]Institute of Botany, Slovak Academy of Sciences, Slovak Republic,
corresponding author: iveta.skodova@savba.sk

[2]Botanical Garden of Ivan Franco National University, Lviv, Ukraine,

[3]Administration of Landscape protected area Strážovské vrchy Mts., Považská Bystrica, Slovak Republic

[4]Uzhorod National University, Faculty of Biology, Ukraine

[5]Soil Science and Conservation Research Institute, Bratislava, Slovak Republic

The area of the western Ukrainian Carpathians is rich in semi-natural grasslands but until now they have not been studied sufficiently using the Braun-Blanquet approach. During 2010-2011 fifty new phytosociological relevés were recorded from meadows and pastures in the Zakarpatskaya oblast, Ivano-Frankovskaya oblast and Lvovskaya oblast regions. The aim of the research was identification of grassland types, evaluation of species diversity, analysis of the main ecological gradients in species composition and estimation of the effect of environmental factors on grassland species composition.

The phytosociological relevés were recorded according to Zürich-Montpellier school. Floristic composition and diversity of several types of mesic grasslands were studied on two spatial scales, 1 m^2 and 16 m^2. The Ward method with relative Euclidean distance as a similarity measure were used for the cluster analysis. The relationships between species composition and selected environmental factors were analyzed by canonical correspondence analysis. For each relevé, information on soil parameters (ph-KCl, content of P, K, Mg, N, C), management (mowing, grazing, ploughing, burning), altitude and solar radiation was gathered. The differences among vegetation types in α-diversity of 1 m^2 and 16 m^2 plots were tested by ANOVA with the post-hoc comparison tests.

Seven grassland types were distinguished in the data set:

1. Intensive pastures, grazed mostly by cattle (*Violion caninae*)
2. Montane pastures and meadows (*Nardo strictae-Agrostion tenuis*, *Polygono bistortae-Trisetion flavescentis*)
3. Former fields transformed to meadows (*Arrhenatherion elatioris*)
4. Permanent meadows at lower altitudes (*Arrhenatherion elatioris*)
5. Pastures at lower altitudes (*Cynosurion cristati*)
6. Abandoned pastures (*Cirsio-Brachypodion pinnati*)
7. Dry grasslands (*Festucion valesiacae*)

The contents of soil P, K and Mg together with pH-KCl, altitude and grazing had significant effects on the variability in the floristic composition of the studied grasslands. The grassland types differed in α-diversity on both spatial scales. The highest α-diversity was indicated in permanent meadows while the lowest one was found in intensive pastures.

This contribution was supported by the Science Grant Agency of Ministry of Education of the Slovak Republic and Slovak Academy of Sciences (VEGA 2/0099/13).

POSTER CONTRIBUTIONS

Study of plant composition of semi-steppe grassland in the Ghorkhood protected area North of Iran

Mousa Akbarlou, Negin Nodehi, Adel Sepehry, Hassan Vahid

makbarlo@yahoo.com

Gorgan University of Agriculture Sciences and Natural Resources, Department of Rangeland
PO Box 386, Shahid Beheshti Street, 4813815739 Gorgan, Iran

Irano-touranian territory with its diverse climatic conditions, including moist weather in the woods bordering the Caspian Sea, dry climate of the desert plain of Loot in central of Iran. Grasslands are located north of Iran between latitude of 37°20`27"" to 37°30`30""N and longitude 56°08`48"" to 56°17`36""E. The elevation ranges between 2100-3150 m and the environment is a cold semi steppe. Study area was located in Ghorkhood protected region in the east north of Iran. For sampling once representative stands in the grasslands were determined and based on representative stands 116 releve 10 m2 was selected. Canopy cover of plants in the releves was determined by method of Braun-Blanquet classification based on percent of canopy cover. The results of this study show that in general 22 families, 65 genera and 74 species were identified in the region.Dominating plants in this grassland are Stipa barbata, Festuca ovina, Agropyron trichophorum, Stipa hohenackeriana, Agropyron cristatum. The life forms present in the region in order of frequency are Hemicryptophytes 47%, Therophytes 19%, Chamophytes 16%, Phanerophytes 10 %, Geophytes 8 %. Predominant life form of region is forbs that comprise 60% of the area, trees and shrubs were observed distributively. As studies show most species present in the region are perennial plants that show adaptation of perennial plants to the semi-arid cold climate of region.

Changes of xerothermic grasslands in the surroundings of Olsztyn near Częstochowa (the Kraków-Częstochowa Upland, Poland) during 35 years

Beata Babczyńska-Sendek, Agnieszka Błońska

beata.babczynska-sendek@us.edu.pl

University of Silesia, Faculty of Biology and Environmental Protection, Department of Geobotany and Nature Protection, Jagiellońska 28, 40-032 Katowice, Poland

In the vicinity of Olsztyn, a small town situated in the northern part of the Kraków-Czestochowa Upland, there are some unforested Jurassic inselbergs with many rocky forms. They are occupied by xerothermic grasslands and separated from each other by sandy depressions. Some rare and interesting plant species are associated with those communities and an endemic species – *Galium cracoviense* is the most important among them.

Dry grasslands which overgrow rocks and slopes of hills near Olsztyn were subject of interest of botanists for a long time. First phytosociological relevés were made here in open rock grasslands in the first half of the 20th century (Kozlowska 1928). Grasslands overgrowing slopes of the hills were investigated in 1975 and several syntaxa of the association or community rank have been distinguished. They represented the Cirsio-Brachypodion pinnati and the Phleion boehmeri alliances (Babczynska 1978). At that time the majority of those grasslands were intensively grazed. In addition, one of the hills (with castle ruins) was intensively trampled. Over the past 35 years grazing has been gradually reduced and today the pasturage discontinued. However, tourism has been intensified. Xerothermic grasslands were changing successively and some of their patches have been overgrown by shrubs and trees.

Investigations of grassland vegetation carried out after 35 years have shown that it has considerably changed. Phytocoenoses dominated by one plant species have become much more common. *Libanotis pyrenaica* and *Allium montanum*, two species that had formerly occurred almost exclusively in the rocky grasslands, are currently common components of grasslands on the slopes of hills. *Libanotis pyrenaica* appeared to be a particularly expansive plant. Its rosette leaves are rather big and shade the lower layers of the sward. Moreover, the share of *Anthericum ramosum* has significantly increased. Grasslands with a large participation of this plant were formerly rare and they are quite common now. At the foot of some hills extensive patches of the Sileno otitis-Festucetum association have developed.

Effects of grazing and mowing on vegetation structure and hay production in protected wet grasslands

Vera Besnyoi[1], Tibor Szerdahelyi[1], Karoly Penksza[2], Sandor Bartha[3]

besnyoi.vera@mkk.szie.hu

1) Institute of Botany and Ecophysiology, Szent István University, Pater K. 1, 2100 Gödöllö, Hungary
2) Department of Nature Conservation and Landscape Ecology, Szent István University, Pater K. 1, 2100 Gödöllö, Hungary
3) Institute of Ecology and Botany, MTA Centre for Ecological Research, Alkotmány 2-4, 2163 Vácrátót, Hungary

Traditional extensive methods of management established valuable semi-natural grasslands in Hungary. Our aim was to investigate how the stability of these human established grasslands can be maintained and how the biodiversity and the reliability of hay production (amount and quality) can be ameliorated.
In our survey we investigated the effects of different types of grassland management on vegetation structure in wet grasslands. The study area is next to Lake Kis-Balaton, in West Hungary. The following treatments were applied: 1, mowing twice a year; 2, grazing by water buffalo; 3, grazing by Hungarian grey cattle; 4, abandonment of mowing and grazing. Treatments were replicated within three mowed and three grazed areas. We hypothesize that i) within a grassland the vegetation structure will diverge due to the effects of different treatments, ii) periodical mowing or the combination of mowing and grazing are more sufficient to sustain reliable quantity of productivity and to improve the quality of hay production than managing only with long term grazing.
Our preliminary results showed that species composition of the three meadows were similar. However, vegetation differed considerably between pastures, probably due to differences in the grazing behaviour of water buffalo and Hungarian grey cattle, and due to variations in groundwater tables. We found that the estimated phytomass values were correlated with water supply. However, high productivity does not necessary mean high quality of hay, therefore the importance of vegetation composition (different nutritional value of particular species) should be emphasized. We also applied line-intercept sampling (detecting the presence of species in 5×5 cm micro-quadrats along 4 m transects). This method offers additional details about the fine-scale diversity and coexistence of species. Within sites no significant differences were found among the replicated plots. This homogeneity provides good starting conditions for monitoring the expected future shifts in species composition, diversity and productivity caused by different treatments.

Ex situ conservation of xerothermic grassland species originating from the Lublin region in the UMCS Botanical Garden, Lublin, Poland

Mykhaylo Chernetskyy, Ryszard Sawicki, Agnieszka Dabrowska, Grazyna Szymczak

m.czernecki@umcs.lublin.pl

Botanical Garden of Maria Curie-Sklodowska University in Lublin, Slawinkowska 3, 20-810 Lublin, Poland

With their unique flora, xerothermic grasslands belong to the most seriously endangered elements of the European vegetation cover. They constitute the richest assemblages of endemic, relic, endangered, and rare species. These valuable assemblages of thermophilous plants that require protection in Poland are characteristic for the Lublin region. Active ex situ and in situ protection of endangered and protected species of the native flora is one of the major activities of the Botanical Garden of Maria Curie-Sklodowska University in Lublin, one of them being reintroduction of selected species in the Lublin region that has been carried out for 20 years.

The present report shows an analysis of the composition of xerothermic plants grown in the UMCS Botanical Garden collected in the Lublin region.

Over 200 vascular species originating from xerothermic communities of the Polish flora have been collected on the steep and dry S and SE slopes of the Garden. They represent various groups of thermophilous plants characteristic of rocky, sandy, floristic, Stipa, and tall-herb grasslands. They include 6 species that are under international protection (Bern Convention), i.e. *Carlina onopordifolia* Besser, *Cypripedium calceolus* L., *Dendranthema zawadzkii* (Herbich) Tzvelev, *Erysimum pieninicum* (Zapal.) Pawl., *Galium cracoviense* Ehrend and *Pulsatilla slavica* G.Reuss.

Over 150 species have been introduced to the collection of xerothermic plants from natural habitats across Lubelszczyzna; these localities were situated in Czumów, Dobre, Dobużek, Gródek, Izbica, Kazimierz Dolny, Kąty, Opoka Duża, Staw, Szczecyn, Tarnogóra, Wirkowice, and Żmudź. The number includes 33 species that are legally protected in Poland and 30 endangered species enlisted in the Polish Red Data Book of Plants (2001) or the Red List of the Vascular Plants in Poland (2006). They represent the following categories of risk: critically endangered (CR) – 7 species, endangered (EN) – 2 spp., vulnerable (VU) – 19 spp., lower risk (LR) – 5 spp., and 15 species that are only protected and most frequently regarded as non-endangered. The most valuable among them are the endangered species, which occur in only a few localities in Poland (*Achillea setacea* Waldst. et Kit., *Carlina onopordifolia, Iris aphylla* L.) or in the Lublin region exclusively (*Chamaecytisus albus* (Hacq.) Rothm., *Echium russicum* J.F. Gmel., *Senecio macrophyllus* M. Bieb., *Veratrum nigrum* L., *Veronica paniculata* L. subsp. paniculata).

Dry grasslands in valleys of big rivers of east-central Poland – influence of abiotic factors on their distribution and diversity.

Iwona Dembicz[1], Łukasz Kozub[1], Piotr Zaniewski[2]

i.dembicz@biol.uw.edu.pl

1) Department of Plant Ecology and Environmental Conservation, University of Warsaw, Al. Ujazdowskie 4, 00-478 Warsaw, Poland
2) Department of Molecular Plant Physiology, University of Warsaw, ul. Miecznikowa 1, 02-096 Warsaw, Poland

Valleys of big, lowlands rivers are places of high concentration of valuable types of vegetation in Poland. Among them there are also dry grasslands that expanded in this region mainly as a result of deforestation and pasture management. The aim of our study was to investigate the influence of several factors on the distribution and diversity of dry grasslands in Bug, Narew and Vistula valleys. In total 48 relevés with soil samples were collected from dry grasslands within the study area. Relevés were classified by means of TWINSPAN analysis and Detrended Correspondence Analysis (DCA) ordination method. Soil samples were processed to determine pH, conductivity, organic matter content (loss at ignition) and share of different fractions. Canonical Correspondence Analysis (CCA) was used to check the correlation between floristic composition and abiotic factors.

Three types of dry grasslands (all belonging to Koelerio-Corynephoretea class) were distinguished:

Corynerophorion canescentis grasslands- such type of vegetation occupy small areas on acidic sandy substrate, often on the edges of valleys, on inland dunes or abandoned crop fields. It is not used nowadays, its occurrence is a result of natural succession on open sandy areas (fallows, places of former grazing, place of overexploitation of private pine forests , places of medium intensity of “off-road” etc.).

Armerion elongatae grasslands – the most common type of dry grassland in the studied area, they occur on plain or slightly undulating areas of upper terraces of valleys, on fine sandy slightly acidic substrate with noticeable portion of silt. They were grazed in near past, but now they are often not used and they subject to expansion of *Calamagrostis epigejos* and/or *Festuca rubra*.

Koelerion glaucae grasslands – they occupy small patches of extreme habitats close to the riverbed or on the slopes of the valleys. Their soils are characterized by higher pH and very often by high gravel content. In the past they were utilised as extensive pastures, now they suffer due to the abandonment.

European semi-natural grasslands under the triple threat of land-use change, climate change and biotic invasions: the BiodivERsA project SIGNAL

Jürgen Dengler[1], Anke Jentsch[1], Jürgen Kreyling[2], Carl Beirkuhnlein[2], Camilla Wellstein[2]& the SIGNAL Consortium

juergen.dengler@uni-bayreuth.de

1) Disturbance Ecology, BayCEER, University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany
2) Biogeography, BayCEER, University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany

Semi-natural grasslands are a prominent feature of European cultural landscapes. They have evolved under millennia of low-intensity human land use, host a very high fraction of the continent's biodiversity and play a key role in agricultural production. Like all other ecosystems, they are recently facing the multiple threats of anthropogenic global change. In the newly started BiodivERsA research project SIGNAL, an international team of researchers, including many EDGG members, is trying to analyse how three major components of global change affect European semi-natural grasslands, namely climate change, land use change and biotic invasions. This triple threat is exemplified by extreme droughts (statistical 1000 yr recurrence), land use intensity gradient (cutting height 3 cm, 10 cm and abandonment) and neophyte invasion (*Lupinus polyphyllos* as a legume and *Senecio inaequidens* as non-legume forb). The effects of these factors on biodiversity and ecosystem functions and services are assessed in a fully factorial design in a field experiment across nine countries along an climate gradient from Belgium and France to Turkey and Israel as well as a mesocosm experiment involving most of the same countries. Further, we ask whether certain components of biodiversity (species diversity, intraspecific diversity and functional diversity) might make grasslands more resilient against negative effects of drought, intensified management or biotic invasion. SIGNAL aims at extrapolating the experimental findings to the European semi-natural grasslands in general by use of vegetation databases, remote sensing and GIS modelling and at making the results applicable in agriculture and land-use management through intensive stakeholder contacts. In our contribution, we will present the concept of SIGNAL and the underlying hypotheses as well as possibilities for EDGG members to get involved in the stakeholder process.

Present state of *Iris pumila* L. populations in the Middle Southern Bug region (Ukraine)

Inna Didenko, Tatiana Shvets

didenko_ip@mail.ru

National Dendrological Park Sofiyvka, National Academy of Science of Ukraine
Kyivska str. 12a, 20300 Uman, Ukraine

The Bug region (Ukraine) and clarify the status of their populations. Research was carried out during the 2011-2012 in the Kirovograd province: population 1 — Ulyanovka district, the former village Vasylivka, population 2 — Hayvorons`kyy district, Haivoron town, left bank of the Southern Bug, population 3 — Kompaniyivskyy district, vicinity of Hanivka village. Ontogenesis and age structure of the coenopopulations were studied on the base of principles and standard methods of plant population biology (Rabotnov, 1950, Uranov & Smirnova, 1969, 1975). Among the investigated populations the most numerous and the largest is the coenopopulation 3. Its number is 109 individuals. This population characterized by normal complete right-side age spectrum with a maximum at virgin group of individuals. A high percentage of young individuals were explained by low total cover of vegetation. Density of individuals is 25-40 / m2. Distribution of individuals is more or less even; sometimes generative individuals form small clusters. Populations 1 and 2 are in a certain anthropogenic impact. The immature group of individuals is dominated in their age spectrum, indicating intensive vegetative reproduction, i.e., there is a process of rejuvenation that is displayed in the left-side shift of the coenopopulations age spectrum. These populations have a low number (20 to 50 individuals) and low density (5-10 individuals / m2). However, despite the low competitive ability, high sensitivity to changes of environmental conditions, in the absence of significant anthropogenic impact these populations retain their positions for a long time. So, taking into account that the studied populations are characterized by low variability, it is necessary to carry out continuous monitoring of their state also to determine the vitality and dynamics of their development, in order to objectively assess the population's state and conservation measures.

Assessment of direct human impact on saline meadow functioning of the Kiliyan Danube Delta

Taras Dvoretskyi

geobot@ukr.net

M.G. Kholodny Institute of Botany, National Academy of Science of Ukraine Tereshchenkivska str. 2, 01601 Kyiv, Ukraine

Floristic composition, plant cover of each species of communities changed under natural and anthropogenic factors is considerable as a vector of multidimensional space forming the vegetation. An assessment method of allowable load on this region was developed by virtue of a theory "destruction risk of ecosystem from human impact". Modeling of different load was on coenoses of the class Juncetea maritimi Br.-Bl. et al. 1952 em Beeftink 1965.

Initial state of communities of this class is determined by assessment of its components caused by natural dynamics of quotient of similarity by the species composition and its plant cover. Assessment range of conditionally undisturbed parts of coenoses under natural conditions corresponds to probability of their existence close to 1. It is considered that the first level is up to such human impact does not take out the state of coenose components beyond the limits of natural fluctuations of the picked out assessments. Increasingof lower values of complex assessments of communities reflected decreasing of probability of their existence in the initial state, which in fact is else slight.

The second level for convenience is up to human impact, which takes out the state of coenose components beyond the limits of natural fluctuations. But eliminating anthropopressure and in favorable natural conditions the communities preserve the ability to self-repair. Under adverse natural conditions for development of investigated coenoses the probability of their preservation at this phase is considerably beneath as compared with 1.

The third level is up to human impact leading to the quantitative changes of the class Juncetea maritimi coenoses. It is described by crossing of complex assessment values via extremum. Probability of community existence in the state close to initial descend to critical value. Little increase of anthropogenic load can lead to a sharp decrease of its existence probability.

The further increase of anthropogenic influence (the fourth level) to the class Juncetea maritimi communities leads to degradation of its basic components. Probability of coenose repair up to conditionally undisturbed state approaches zero.

The suggested method allows to detect in the most reliable way the permissible anthropogenic influence with account of coenose state in fact. Thereupon it is necessary to develop the norms of nature use of the Kiliyan Danube Delta ecosystems with an allowance for permissible risk.

The history of the formation of extrazonal ranges of species representing Pontic - Pannonian element in Central Europe

Cieślak Elżbieta

e.cieslak@botany.pl

W. Szafer Institute of Botany, Polish Academy of Science, Lubicz 46, 31-512 Kraków, Poland

In the area of Central Europe, the species associated with the xerothermic communities, occurring extrazonally in areas of combined suitable orographic, soil and microclimate conditions, form a distinctive repetitive pattern of distribution. A question is addressed whether nature of contemporary ranges of the species in this part of Europe is conditioned by historical factors (being a relict) or it is result of relatively recent migration (related to human activities). To stimulate discussion on history of the formation of these ranges, molecular studies (AFLP method) were carried out. Representative group of species of Pontic - Pannonian element, namely *Carlina onopordifolia*, *Cirsium pannonicum* and *Linum flavum* were chosen for detailed investigation.

The analysis of the level of genetic variability and structure showed that the major migration route of this group of species, to locations in the northern part of Central Europe, led from the East and the South-East along the northern side of the Carpathians. From the southern areas these pathways led through the Bessarabian Gate and the Podolian Upland belt. The Sudeten-Carpathian mountain chains were a barrier for these species during the migration. As a consequence, passing in northwestern direction took place on both sides of the Carpathians, independently. On the other hand, the genetic diversity of the population pool of the Małopolska Upland in relation to the Lubelska Upland (both areas on the north side of Carpathians) may indicate the presence of more than one migration to the site. It should be noted, that the earliest appearance of the species in that area may have occurred after a period of glaciation Sanian I - Sanian II (Mindel) (430 thousand years BP), during the Pleistocene.

This work was financially supported by NCN (National Science Center, Poland) grants no. N 304 15 46 33 and no. N N304 3000940).

Cieślak E. 2013. Phylogeography of xerothermic species in Central Europe.Polish Botanical Studies. 30 (in press).

The order Brachypodietalia phoenicoidis in the Iberian Peninsula: syntaxonomy and relationship with climatic parameters

Itziar García-Mijangos[1], Asun Berastegi[2], Idoia Biurrun[1], Ainhoa Darquistade[3], Mercedes Herrera[1], Javier Loidi[1], Juan Antonio Campos[1]

itziar.garcia@ehu.es

1) Dept. Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country UPV/EHU, Apdo. 644, E-48080 Bilbao, Spain
2) Área de Biodiversidad, Gestión Ambiental de Navarra, S.A., Padre Adoain 219 Bajo, E-31015 Pamplona, Spain
3) Área de Medio Ambiente, IDOM, Avda Zarandoa 23, E-48015 Bilbao, Spain

The phytosociological order Brachypodietalia phoenicoidis includes tall grass pastures growing on base-rich deep soils in dry-subhumid mediterranean and temperate submediterranean areas in Western Mediterranean and Pyrenees. Two alliances are recognized: Brachypodion phoenicoidis and Artemisio albae-Dichantion ischaemi.
The aim of this study is to conduct a syntaxonomic review of the order in the Iberian Peninsula and verify if the distribution of phytocenoses is related to climatic parameters. The relevés have been extracted from the Information System of the Iberian and Macaronesian Vegetation (SIVIM) and the Vegetation Database of the University of the Basque Country (BIOVEG). The initial floristic matrix gathers 1116 relevés belonging to 20 associations. A stratified random resampling by syntaxa and 10x10 km UTM grid was carried out with a final data-set formed by 482 relevés.
Ginkgo program of the VEGANA package was used to perform the multivariate analysis. Braun-Blanquet cover values were transformed according to Combined scale and square-root transformation. Species occurring only in one or two plots were filtered and the dissimilarity matrix was constructed using Bray-Curtis distance. Fuzzy C-means (FCM) clustering with two groups was performed in order to validate current classification of the order in two alliances.
Preliminary results show a clear segregation of the relevés into two clusters that mostly match with Brachypodion and Artemisio-Dichanthion alliances. The only relevant change is that most of the relevés from submediterranean southern foothills in the Basque-Cantabrian mountains, currently classified in Brachypodion, have been grouped with the pyrenean relevés of Artemisio-Dichanthion. These grouping enhances the temperate submediterranean nature of this alliance, contrary to the mediterranean genuine grasslands of Brachypodion phoenicoidis. Characteristic species of Brometalia grasslands such as *Bromus erectus*, *Briza media, Festuca gr. rubra* and *Avenula mirandana* have diagnostic value for these submediterranean communities.

Conservation of Dianthus hypanicus Andrz. and Silene hypanica Klokov at the ex situ conditions in National dendrological park Sofiyvka NAS of Ukraine

Ludmila Goncharuk

l.14.04.88@mail.ru

National Dendrological Park Sofiyvka, National Academy of Science of Ukraine
Kyivska str. 12a, 20300 Uman, Ukraine

Dianthus hypanicus Andrz. and *Silene hypanica* Klokov are rare endemic species, which are included to the Red Data Book of Ukraine (2009), European Red List (1991) and to the Annex I of the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) (1979). In spite of this, primary locations of the species disappear and the area of its distribution dramatically reduces. At the same time, these species are of great interest for scientists, as they are narrowly localized south-Bug-Ingulz endemic species, they have ornamental peculiarities and deserve wide introduction to the culture. *D. hypanicus* and *S. hypanica* have been cultivated in National dendrological park «Sophyivka» NAS of Ukraine since 2011. They were introducted as seeds from different natural location of Mukolaiv region. In NDP «Sophyivka» NAS of Ukraine research regarding reproduction in ex situ and in vitro conditions are carried out by the laboratory at microclonal propagation of the Physiology, Genetics, Selection and Biotechnology of plants. During the investigation different conditions of sowing were used. The germination of *D. hypanicus* seeds modified from 65 to 95 %, for *S. hypanica* - from 63 to 98 %. The highest rate of germination of seeds was observed in laboratory conditions during the growing in Petri dishes: *D. hypanicus* – 90-95 %, S. hypanica – 97-98 %. The results revealed that the seeds of *D. hypanicus* have a period of germination from 2 to 12 days, and *S. hypanica* – from 4 to 10 days. The methods of *D. hypanicus* and *S. hypanica* in vitro cultivation were developed with the aim to obtain the mass quantity of plant material. The optimal time for introduction of the seeds of *D. hypanicus* to in vitro culture is September, and *S. hypanica* – December. Under this condition the germination rate is about 80 %. Thus, as the result of the research, we obtained plant material of *D. hypanicus* and *S. hypanica* for planting at the plot of the Red Book of Ukraine plants. In the future we plan to reintroduce this species into the natural locations in Mukolaiv region, Arbuzynsky district, between the villages Schutske and the Vynogradny Sad villages, which suffered because of the high level of water in Oleksandrivsky reservoir at the Southern Bug River.

The distribution of dry grassland plant species along road verges in agricultural landscape of the Zemgale Lowland: Preliminary results

Lauma Gustina, Solvita Rusina

Lauma.Gustina@lu.lv

University of Latvia, Alberta str. 10, LV1010 Riga, Latvia

Semi-natural grasslands cover only 0.7% of the territory of Latvia and most of them are located in river valleys. This research took place in the Zemgale Lowland, where more than 67% of the agricultural lands are used as arable land. The majority of the Lowland's rivers flows from the South to the North and the valleys are connected by a dense network of roads. Our goal was to inventory localities of semi-natural dry and mesic grassland species located on road verges.

We inspected 50 km of road verges. The methods we used were photography and vegetation description of localities according to the Braun-Blanquet method. Photos were taken every 500 m to document road verges morphology. Every locality of semi-natural grassland plant species was described if it was located not more than 20 m from the edge of the road.

The analysis of the photos indicated that 51% of surveyed roads were surrounded by arable land from both sides, 36% of roads were surrounded by arable land from one side and only 13% of roads were surrounded by habitats other than arable land from both sides. In general, only 20% from all surveyed road verges were theoretically suitable for grassland plant species.

94 localities of semi-natural grassland species were described. 77 % of them were located less than 4 m from road, but 22% - less than 1 m from road. 47% of all localities were located in places where total width of vegetation belt suitable for grassland species was wider than 10 m.

The analysis of quality of localities was carried out according to quality criteria. 12% were low quality localities not suitable for development of grassland vegetation. These localities were on average 0.7 m from road. There were no trees, houses or other objects nearby. 55% were medium quality localities. These localities lie on average 2.7 m from road. 33% were high quality localities suitable for grasslands. These localities lie on average 4 m from road.

Previous research indicated that in the Lowland only 5 % of localities of semi-natural grassland species were located on road verges (data of the Institute of Botany of the University of Latvia 1970-1990), but now we can conclude that the role of road verges is much larger. Preliminary results indicate that road verges with trees and more than 2 m wide are more suitable for grassland species than those without trees and only 0.5-2 m wide.

The red-listed *Cheilotoma musciformis* leaf-beetle – making use of genetics for steppic species conservation in Poland

Łukasz Kajtoch[1], Daniel Kubisz[1], Milosz A. Mazur[2], Dorota Lachowska-Cierlik[3]

lukaszkajtoch@poczta.fm

1) Institute of Systematics and Evolution of Animals, Polish Academy of Science
Sławkowska 17, 31-016 Cracow, Poland
2) Center for Biodiversity Studies, Department of Biosystematics, Opole University, Opole, Poland
3) Institute of Zoology, Jagiellonian University, Cracow, Poland

Steppe-like habitats in Poland are seriously threatened as a result of natural succession and anthropogenic degradation. Considering the loss of ranges of steppic invertebrates, the evaluation of genetic variation in their populations is of immediate importance if appropriate conservation measures are to be undertaken. The leaf-beetle *Cheilotoma musciformis* is a highly endangered steppic beetle included in Polish Red Data Book of Animals. Polish population of this species is highly geographically isolated from its continuous range. Range of *Cheilotoma musciformis* in Poland is limited to five areas in Central Uplands, however some of these subpopulations recently became extinct or are severely declining. Genetic analyses of mitochondrial and nuclear markers have shown that the Polish *C. musciformis* beetles are distinct from the nearest populations in Slovakia and Ukraine and the Polish population should be considered as an independent conservation unit. Very little (mtDNA) or no (nuclear DNA) diversity has been found among the Polish subpopulations, what suggest that they had gone through a strong bottleneck leading to a drastic reduction in its genetic diversity. Host plants have been identified for this species using barcodes, and the only host for the Polish samples is *Sainfoins Onobrychis* spp., similarly like in Ukraine but not in Slovakia where these beetles feed on other Fabaceae. All of these data can be very valuable for the conservation of *Cheilotoma musciformis* populations in Poland. This work has been recently used for writing a petition to include *Cheilotoma musciformis* species into the Polish list of strictly protected animals.

Monitoring geo-biodiversity interactions on a restored inland drift-sand cell in Nieuw Bergen (The Netherlands)

Rita Ketner-Oostra[1], Piter Ketner[1], P.D. Jungerius[2], H.van den Ancker[2], A. Arts[3], I. Borkent[4]

rita.ketner.oostra@gmail.com

1) Freelance ecologist, Algemeer 42, 6721GD Bennekom, Netherlands
2) Foundation Geomorphology & Landscape, Ede.
3) Municipality Bergen (Limburg)
4) Foundation De Marke, Slijk-Ewijk.

In 2002, the authors investigated the possibility to restore inland drift-sand areas in N. P. `De Maasduinen` in Nieuw Bergen, province of Limburg. The active drift-sand area designated as Natura 2000 habitat type 2330: "Inland dunes with open Corynephorus and Agrostis grasslands with many Red listed lichen species"" had completely disappeared from the area by the eutrophication as result of nitrogen-rich precipitation. It was decided to restore the drift sand as depicted on aerial photographs of 1933. The areas stabilized since then were overgrown mainly by the alien invasive moss *Campylopus introflexus*, a species associated with changes in abiotic conditions.
In 2005, the first active drift-sand cell was restored by increasing the erodibility of the terrain, by mechanically removing the 5 cm thick sod formed since 1933. The erosivity of the wind was reinforced by removing trees in the upwind direction. Areas colonized by lichens were spared as centres for recolonization.
In 2010, five years after the restoration, the active drift-sand cell had turned into open dry grassland again, almost completely dominated by *Corynephorus canescens*. However, the centres for recolonization of lichens, lying in the transport zone, had acted as sandtraps, and most species had disappeared.
From the Natura 2000 viewpoint the restoration measures were very successful as the terrain classifies as habitat type 2330. Different views exist on further management. One option is to try and create a situation with a fragile equilibrium between blowing sand and pioneer vegetation. An active erosion- and transport-zone could be promoted by regularly removing mechanically *Corynephorus canescens* and cutting of more trees to increase the wind force. Another option is to let vegetation succession have its way.

Scientific and educational values of the xerothermic species collection of the Department of Rare and Endangered Plants of Polish Flora at the Adam Mickiewicz University Botanical Garden in Poznań

Alicja Kołasińska, Wanda Wójtowicz

alicjak@amu.edu.pl

Adam Mickiewicz University, Botanical Garden, Dąbrowskiego 165, 60-594 Poznań, Poland

The Department of Rare and Endangered Plants consists of 5 sites of varied habitat conditions suitable for plants having various ecological requirements. The site destined for plants of xerothermic habitats from the Festuco-Brometea class is located in the eastern part of the Garden, on a small slope with southern exposure. It harbours 69 taxa from natural locations from Poland, Germany, Lithuania, Hungary, Romania and France. Of all plants gathered in the collection, some are especially worthy of notice due to their very rare occurrence in Poland, i.e. *Dictamnus albus* L., *Veronica paniculata* L., *Echium russicum* J.F.Gmel., *Anthericum liliago* L., *Linum austriacum* L. and *Lithospermum purpurocaeruleum* L.

The collection was established in the early '80s in order to carry out ex situ experiments connected with research on rare and endangered species of Polish flora. The collection has been gradually enlarged by further species from the "Polish Red Book of Plants" and regional lists. Research outcomes were published for the following taxa: *Arnica montana* L., *Dianthus gratianopolithanus* Vill., *Dictamnus albus*, taxa from the genus *Pulsatilla*, *Stipa joannis* Čelak., *Stipa capillata* L. and *Trollius europaeus* L. At present further research is conducted, e.g. on biology, autecology and ex situ cultivation methodology. The collection serves also for teaching purposes for schools and academic institutions, as well as for popularizing the idea of nature preservation among the society.

This collection is an example of the realization of the Global Strategy for Plant Conservation as expressed in the publication concerning the Botanic Gardens Conservation Strategy by the Botanic Gardens Conservation International (BGCI).

„Management of endangered habitat types within nature reserves in Mazovia and Podlachia" – a new project aimed at termophilous vegetation conservation in Poland

Łukasz Kozub[1], Paweł Pawlikowski[1], Magda Galus[2]

kozub.lukasz@gmail.com

1) Department of Plant Ecology and Environmental Conservation, Institute of Botany, Faculty of Biology, University of Warsaw, Al. Ujazdowskie 4, 00-478 Warsaw, Poland
2) Wetland Conservation Centre, Cieszkowskiego 1/3 lok. 31, 01-636 Warsaw, Poland

Thermophilous habitats and related flora are not so widespread in central and north-eastern Poland as in the southern part of the country. However, the above region does hold valuable species, especially of subcontinental distribution. Most of the open, warm habitats of that area existed as a result of centuries-long extensive agricultural (pastoral) use. Since the mid-twentieth century due to the changes within countryside those activities stopped and valuable habitat types started to disappear overgrown with more mesic vegetation.

The most floristically valuable patches of thermophilous habitats have been protected by national law. However, it has not prevented them from succesional changes due the lack of management. Wetland Conservation Center begun a project: "Management of endangered habitat types within nature reserves in Mazovia and Podlachia" which aims at conservation and restoration of EU importance habitats as semi-natural dry grasslands on calcareous substrates (6210) and thermophilous oak forests (91I0).

Management of the first habitat would be implemented within two areas: Bug river valley near Polish-Byelorussian border (reserve "Góra Uszescie" and proposed protected areas "Głogi" and "Góra Rowska")and Vistula river valley in the southernmost part of Masovian Voivodeship (reserve "Sadkowice" and proposed reserve "Raj"). Apart from the habitat itself those areas have valuable floras including such species as *Allium montanum, Aster amellus, Anemone sylvestris, Campanula sibirica, Linum flavum, Pulsatilla pratenis, Scorsonera purpurea.* Within both areas dry grasslands have decreased their area due to shrub encroachment. Within the project shrub removal and mowing of the grasslands will be implemented.

Reserves protecting thermophilous oak forests included in the project are scattered around the Masovian Voivodeship. Project activities will cover reserves "Brwilno", "Kawęczyn", "Dąbrowa Radziejowicka", "Dąbrowy Seroczyńskie" and "Podjabłońskie". The valuable flora of the reserves include *Campanula bononensis, Melittis melisophyllum, Digitalis grandiflora, Potentilla alba, Peucedanum cervaria, Prunella grandiflora.* Within those reserves management would include removal of the forest understorey and mowing.

Ecological effects of the project will be monitored. Within each reserve monitoring plots will be established in a form of split-block experiment including two separate treatments (mowing and shrub/understorey removal) and a control plot.

Ecology and syntaxonomy of mesic and dry grasslands of the colline area in NE Croatia

Daniel Krstonosic[1], Jozo Franjic[1], Zeljko Skvorc [1], Krunoslav Sever[1], Andraz Carni[2]

dkrstonosic@sumfak.hr

1) Faculty of Forestry, Univesity of Zagreb, Svetosimunska 25, 10 000 Zagreb, Croatia
2) Institute of Biology, Scientific Research Center of the Slovenian Academy of Sciences and Arts, Novi trg 2, SI 1001 Ljubljana p. box 306, Slovenia

The research was conducted on the Slavonian Mountains (NE Croatia), which are situated on the border of the Pannonian and Illyrian floristic area between different climate influences (alpine from the west, dinaric to the south and pannonian from the east and north). In the colline and hilly landscapes a great mosaic of mesic and dry grasslands (pastures and meadows) is formed on a variety of bedrocks from silicate and sandstone to limestone and marlstone. Since dry and mesic grasslands are characterized by a rich biodiversity and ecological value, they are a priority for conservation in Croatia, as well as in Europe. This is clearly emphasized in the Bird and Habitat Directive of NATURA 2000. This is even more supported by the fact that such habitats are slowly disappearing under the pressure of forest vegetation. Previous research of grasslands in this area was very scarce, now the ecological, phytogeographycal and syntaxonomic affiliation of mesophilous, semi-dry and dry grassland associations was defined using modern methods of vegetation analysis. According to the Twinspan analysis seven different communities could be distinguished, one of them (Scabioso ochroleucae-Brachypodietum pinnati Klika 1933) was described for the first time in the researched area. Communities of the class Festuco-Brometea clearly differ in all ecological variables in relation to communities of Molinio-Arrhenatheretea. Thus, the former occur in higher elevations, on steeper slopes, they are characterized by lower EIV for moisture. On the other side they have higher EIV for light, temperature and continentality and lower pH. Festuco Brometea communities share a large number of the south and southeast European floristic elements, while Molinio-Arrhenatheretea communities have a higher proportion of cultivated and adventive plants.

Phytosociology of *Pulsatilla pratensis* (L.) Mill. in the Right-Bank Forest-Steppe of Ukraine

Anna Kuzemko, Mikhail Chekanov

anya_meadow@mail.ru

National Dendrological Park Sofiyvka, National Academy of Science of Ukraine
Kyivska str. 12a, 20300 Uman, Ukraine

Pulsatilla pratensis (L.) Mill. is rare species listed in the Red Data Book of Ukraine with the status “not evaluated”. The aim of our study was to determine a phytosociological peculiarities of the species in the Right-Bank Forest-Steppe of Ukraine. Materials for the study were 32 relevés from Khmelnytsky, Vinnytsia, Kirovograd, Odessa and Cherkasy regions made during 2004-2012 years, including 18 relevés made by authors and 14 — from literary and archival sources. All relevés included in the “Ukrainian Grasslands Database” (EU-UA-001 in GIVD). Data processing was carried out in the JUICE program by algorithm TWINSPAN modified and DCA–ordination by R-project program using ecological scales of Ya.P. Didukh (2011). As a result, it was established that the communities with the participation of *Pulsatilla pratensis* in the Right-Bank Forest-Steppe of Ukraine belong to the two classes of vegetation — Festuco-Brometea Br.-Bl. et Tx. ex Soó 1947 and Koelerio-Corynephoretea Klika in Klika et Novák 1941. Within the first class this species is presented in three associations — the Astragalo austriaci-Salvietum nutantis Korotchenko & Didukh 1997 (the Cirsio-Brachypodion pinnati Hadač et Klika in Klika et Hadač 1944 alliance), the Festuco valesiacae-Stipetum capillatae Sillinger 1930; Koelerio macranthae-Stipetum joannis Kolbek 1978 (Festucion valesiacae Klika 1931 alliance), and within the second class it is presented in the Centaureo borysthenicae-Festucetum beckeri Vicherek 1972 association (Festucion beckeri Vicherek 1972 alliance). As a result of ordination two classes were divided by a factor of soil reaction along the first ordination axis, and three associations of the Festuco-Brometea class were divided along the third ordination axis, which corresponds to the humidity vector. Environmental features of the *Pulsatilla pratensis* habitat have been established and it should be taken into consideration in selecting environmental conditions for the cultivation of this species ex situ.

Relevance of plant traits for migration success of target species to former cropland on semi-dry grassland sites in Sankt Anna am Aigen (SE-Austria)

Martin Magnes, Philipp Sengl

martin.magnes@uni-graz.at

Institute for Plant Sciences, University of Graz, Holteigasse 6, A-8010 Graz, Austria

Semi dry grassland is critically endangered in Austria, especially in the intensively cultivated regions throughout the SE alpine foreland. For this reason the “Naturschutzbund Steiermark”, a non-profit organization, acquired an arable field and an apple orchard on potential semi dry grassland sites to restore high value grasslands (Cirsio pannonici-Brometum). The restoration method includes mowing once a year with biomass removal, but no further treatment regarding to the beneficial location directly next to species rich grassland sites.

The issue of this study was a vegetation-ecological investigation of the early successional states of the restoration area. The role of plant traits as well as abiotic site parameters were considered to interpret the vegetation patterns found on the three year old restoration sites.

The investigated area is located in the southeastern alpine foreland of Austria near the community of St. Anna am Aigen (46.81N/15.98 E- 46.81 N/15.99 E; 281 - 297 m above sea level). The soils are non calcaric Cambisol, Stagnosol and calcaric Leptosol. The annual precipitation is between 841.2 – 831.4 mm and the annual mean temperature between 9.1 – 9.3°C (1971-2000).

The applied methods included vegetation sampling (Braun-Blanquet approach, 16m²) along seven transects, each starting from the Brometum into the restoration sites. Furthermore soil parameters (K, P, pH) and distance of the samples to the nearest boundary of semi dry grassland were recorded.

The migration process was tested statistically if there are coincidences in the vegetation patterns considering the plant traits of target species and the abiotic parameters (soil, distance).

In three year old restoration sites migration has just begun. Though the total vegetation cover of the sites is up to 70-90 percent, the dominant species are of the Arrhenaterion and of thermophile ruderal associations. Investigations of the ecological strategy show that small stress-adapted species of the Bromion are underrepresented. While most of the tested plant traits show no correlation with the migration success of species, a long period of flowering, low seed weight, high Ellenberg indicator values for N and the maximum plant height obviously promote immigration ability. An important abiotic parameter for the migration success of target species into the former field was the distance to Brometum whereas the measured soil parameters showed no significant correlation to the migration process.

Creating a replacement habitat for dry-grassland plant species. Case study of Radzionków Botanical Garden

Magdalena Maślak

magdalena.maslak@gmail.com

Silesian Botanical Garden, Sosnowa 5, 43-190 Mikołów, Poland

Silesian Botanical Garden Union of Associations contains two among the youngest botanical gardens in Poland: Silesian Botanical Garden in Mikolow and Radzionków Botanical Garden. The ex situ collection of native plants is conducted in SibG by the Department of Habitat Collections and The Silesian Seed Bank.

The natural area of botanical gardens are deciduous and mixed forests, periodically flooding and fresh meadows, fields under cultivation and grasslands. Because of the diversity of accessible habitats and its relatively large area, the Silesian Botanical Garden has particular opportunities to protect large populations of plants which are headed for extinction in Silesia, in natural and semi-natural environments. Some of the area of the botanical gardens are post-mining sites, abandoned after the exploitation of limestone. In 2011 Habitat Collections of Dry Grassland species was established on the post-mining area in Radzionków, partly as a result of the project "Construction of the infrastructure essential for the creation of a priority substitute habitat (6120-1) of semi-natural dry grassland communities in Księża Góra, Radzionków". In order to obtain rare and endangered plant specimens for this collection, the SiBG initiated a cooperation with Polish botanical gardens which possessed collection of that kind – the Adam Mickiewicz University Botanical Garden in Poznan and the Botanical Garden of Maria Curie-Sklodowska University in Lublin. The main goal of the project was to create a habitat in order to facilitate biodiversity conservation in populations of rare plants endangered by infrastructural investments, such as: roads, housing estates, factories, large aquifers etc. As part of that project, a habitat of Xeric sand calcareous grasslands and Semi-natural dry grasslands, which belong to a European Union`s ecological priority group, were reconstructed. To this end, a limestone excavation pit with an area of 2 ha and depth of up to 14 meters was adapted. Thanks to topoclimatic conditions, an interesting relief and the presence of many characteristic thermophilic plants this location is perfect for the establishment and maintenance of grassland communities. The created habitat is now a suitable replacement habitat for the threatened and endangered dry grassland species and a research area for community restitution and habitat creation.

Modern trends in plant cover dynamics of the natural landmark "Valley of the Kurgans"

Ivan Moysiyenko[1], Anastasiia Shaposhnikova[1], Barbara Sudnik-Wójcikowska[2], Iwona Dembicz[2]

moysiyenko@i.ua

1) Department of Botany, Kherson State University, 27, 40 Rokiv Zhovtnja, 73000 Kherson, Ukraine
2) Department of Plant Ecology and Environmental Conservation, University of Warsaw, Al. Ujazdowskie 4, 00-478 Warsaw, Poland

The natural landmark "Valley of the Kurgans" (6000 ha) is situated in southern Ukraine (near the village of Ivanivka, Gola Prystan District, Kherson Region), in the desert steppe zone. In the west it is bordered by Yagorlitsky Bay of the Black Sea, in the north and east – by Lower Dniper sand area, and in the south – by fields on former plowed grass steppes. The landmark is located on the saline coastal plain that formed in the place of great-Dniper riverbed. The name "Valley of the Kurgans" is associated with a significant concentration of kurgans (more than 150!).
The tidal level in the Black Sea is very low, however, periodically winds cause flooding of coastal areas by salt water. Biotopes which are rare in Ukraine formed in this area. They are the "equivalent" of Western European saltmarshes. The vegetation is represented by solonchak and solonetz, halophytic meadows, desert-steppe and remnants of grass steppes surviving on kurgans. The above area contains more than 300 species of vascular plants, including 15 sozophytes. We assessed the possibility to establish a landscape park to protect the biodiversity of the area.
The vegetation of the "Valley of the Kurgans" undergoes significant dynamic changes. In our opinion the following three trends are leading:
- halophytization of the steppe vegetation due to periodic flooding and the natural Holocene transgression of the Black Sea. For many centuries steppe communities on the flat areas have been almost completely superseded by halophytic vegetation. Remnants of the steppe vegetation are noted only on the kurgans that were built in the time when the grass steppe vegetation dominated in this area. *Tulipa gesneriana* L. is an example of a plant which survived only on several barrows;
- restoration of natural vegetation after the cessation of grazing. In the Soviet times (till the 1990s), there was intensive specialized sheep farming that caused synanthropization of the flora due to excessive grazing. Today, there are small private farms, which have only a few hundred cows and sheep;
- synathropization of the flora due to massive infestation by *Elaeagnus angustifolia* L. This invasive species was planted in windbreaks. This facilitated the expansion of the species into extensively used pastures (regenerating steppe). *E. angustifolia* caused substantial transformation of open habitats through shading and nitrification. As a result, nitrophilous weeds encroached or survived in the close vicinity of trees.

Cultivation of plant species from petrophyte and sand dry grasslands of the south-east of Ukraine in special expositions in Donetsk Botanical Garden of National Academy of Sciences of Ukraine

Ganna Nazarenko

nazarenko.anna@gmail.com

Donetsk Botanical Garden, Illicha Av. 110, Donetsk 83059, Ukraine

Petrophytic and psammophytic steppes as well as rocky outcrops vegetation are characteristic for vegetation cover of the south-east of Ukraine. Most plant species of these communities are restricted in their distribution to certain habitats type, edafic and coenotic conditions, and thus are vulnerable to destruction of suitable habitats or transformations of vegetation that can occur due to human activity or natural destruction.

Special expositions of petrophyte and psammophyte vegetation of the south-east of Ukraine were founded in Donetsk Botanical Garden in 2004-2007. They aimed at creating artificial model plant communities for ex situ studies of different aspects of biology of specialist petrophyte and psammophyte species, development of introduction populations and artificial plant communities. These expositions represent vegetation of petrophyte steppe and that of granite outcrops, vegetation of chalk outcrops, sand dry grasslands vegetation. To create suitable microhabitats for successful cultivation of target species, plots were prepared by adding special substrates to upper soil layer, and characteristic features of appropriate native communities as well as typical species combinations were reconstructed.

In these special expositions 195 species (371 accessions) are collected, among them 46 rare and threatened plant species. The study of phenology, fitness and reproductive capacity of cultivated plants, seed viability, seed germination patterns, seedling morphology and survival, reproduction of introduction populations of petrophyte and psammophyte species is initiated. The results of ex situ investigations combined with in situ observations enable assessment of the possibility of reproduction and ex situ conservation of characteristic species of petrophyte and sand dry grasslands of the south-east of Ukraine.

Ex situ protection of endangered, dry grassland species of eastern Poland at "FlorNaturOB" program

Maciej Niemczyk[1], Jerzy Puchalski[1], Wiesław Podyma[1], Adam Kapler[1], Piotr Walerowski[1], Antoni Krzyżewski[1], Arkadiusz Nowak[2], Agata Smieja[3]

maciej.niemczyk@obpan.pl

1) PAS Botanical Garden – Center for Bilogical Diversity Conservation in Powsin, ul. Prawdziwka 2, 02-973 Warsaw, Poland
2) Laboratory of Geobotany and Plant Conservation, Department of Biosystematics, Opole University, Oleska 48, 45-052 Opole, Poland
3) Silesian Botanic Garden, Sosnowa 5, 43-190 Mikołów, Poland

There are numerous projects dedicated to in situ conservation of critically endangered and community important species associated with dry grasslands and light, thermophilous oakwoods (eg.: *Adenophora liliifolia* Bess., *Carlina onopordifolia* Bess., *Dracocephalum ruyschiana* L., *Erysimum pieninicum* (Zapał.) Pawł., *Galium valdepilosum* Heinr.Braun, *Muscari comosum* (L.) Mill., *Serratula lycopifolia* L., *Stipa joannis* Čelak, *Thesium ebracteatum* Hayne etc.), but only a few programs focused on their ex situ protection.
Particularly the main conservation measure dedicated to endangered flora protection was the establishment of nature reserve system. Unfortunately for the xerothermophilous swards, the implementation of strict reserves has relatively low effectiveness. Land abandonment, lack of mowing, grazing and periodical wildfires induced secondary succession. As a result, the population of rare and protected by law species, often highlighted at European and Polish Red Data lists, significantly declined. Many populations become so threatened that their unique, genetic resources have to be secured also outside their natural localities – at botanic gardens and gene banks. Key role in modern, ex situ protection of those resources is played by "Conservation ex situ of wild, protected and threatened plants in eastern part of Poland – FlorNaturOB (Polish: "Ochrona ex situ dziko rosnących, chronionych i zagrożonych roślin w Polsce wschodniej – FlorNaturOB)" project. During this program germplasm of 61 species from 161 natural localities will be secured in liquid nitrogen until the end of 2013 at Powsin Seed Bank.Among them there are many species typical for dry grassland and steppe-forests habitats, some of them vulnerable or even critically endangered in Poland, yet still not protected by law eg.: *Veronica praecox* All., *Arabis recta* Vill., *Allium rotundum* L., *Bupleurum tenuissimum* L. etc.

Potentilla rupestris L. in Lower Silesia – occurrence and threats

Paweł Pech[1], Sebastian Świerszcz[2], Grzegorz Swacha[3]

pawel.pech@biol.uni.wroc.pl

1) University of Wroclaw, Faculty of Biological Sciences, Wrocław, Poland
2) Department of Agroecosystems and Green Areas Management, Wroclaw University of Environmental and Life Sciences, pl. Grunwaldzki 24 A,50-363 Wrocław, Poland
3) Department of Biodiversity and Plant Cover Protection, University of Wrocław, Kanonia 6/8, 50-328 Wrocław, Poland

Potentilla rupestris is a species with a circumpolar range of occurrence. In Europe, it is found mainly in its central part and in the Balkan countries. Its range of occurrence in Poland is restricted to the lowlands and uplands. At present, it has been reported from several localities with the exception of Pomerania and southern parts of the country. In Lower Silesia, a species is known from a numerous historical localities, but many of them still require confirmation. In total, *Potentilla rupestris* was found at ca. 30 sites within the region. A single specimen is characterized by a high vitality level and it can survive up to 30-40 years.
Potentilla rupestris is a xerothermic plant species that often grows in ecotones between forests and scrubs. The species is associated with shrub communities of the Rhamno-Prunetea class with a great share of species from the Trifolio-Geranietea sanguinei. It is also found on slopes covered by grasslands from the Brometalia erecti.
Status of each population known from the Lower Silesia may differ to a large extent. Populations with only one flowering shoot are observed as well as population with dozens or even hundreds of flowering individuals.
The main threat to the species is the disappearance of thermophilic communities because of its shade intolerance due to overgrowing by scrubs. Additionally, strong anthropopression in the form of littering and devastating its habitats is the reason why the species disappear.

Effect of prescribed burning and spontaneous patched fire on the community of cursorial spiders in the forb steppes of eastern Ukraine

Nina Polchaniova

polchaninova@mail.ru

V. N. Karazin Kharkiv National University, Svobody sq. 4, Kharkiv, 61022, Ukraine

Effect of fire on the steppe biome depends on many factors: season, intensity, frequency, site area, vegetation character, state of adjacent habitats, ecological peculiarities and life stage of species, etc. The objective of our investigation was to monitor the post fire recovery of spider communities after a single prescribed spring burning in petrophyte forb-bunchgrass steppe in southeastern Ukraine and periodical spring and autumn fires in the gully forb steppe in northeastern Ukraine.

In the first case, fire did not cause catastrophic damage to cursorial ground-dwelling spiders, a mobile group of invertebrates that settle quickly in new habitats and conquer vacant ecological niches. Araneocomplexes of unburnt and burnt plots differed dramatically only in the first year after the fire. In the burnt plots species richness was higher and dynamic density was lower than in control (52 and 34 species, 78 and 97 ind./100 trap-days, respectively). Eresidae and Salticidae species preferred burnt plots while Linyphiidae was more abundant in unburnt ones. Dominance complex of unburnt steppe was represented by one species (*Alopecosa pulverulenta*) while in unburnt plots, it consisted of tree species (*A. solitaria*, *Trochosa ruricola*, *Eresus kollari*). The following year, spider diversity dropped in both plots and did not differ significantly (39 and 41 species; 48 and 40 ind./100 trap-days in burnt/unburnt steppe, respectively). Difference between families diminished, with the exception of Eresidae being more abundant in the site of fire.

In gully steppe in case of periodical burning, spider complexes of the fire sites were significantly poorer than in control (18-24 and 35 species, respectively). The gnaphosid species richness increased from the newly burnt (5) to unburnt plot (11) while that of the lycosids was stable in all the studied plots. Individual number was higher (57-67 ind/100 trap-days to 37 ind. in control) due to abundance of lycosid spidlings. In intact steppe, dominance complex of spiders was complicated, with juvenile lycosids as superdominants and six adult lycosids and gnaphosids as dominants. In three burnt plots in the first-third years after the fire, dominance complex consisted only of juvenile and one or two adult Lycosidae. High abundance of *Xerolycosa miniata* registered there indicates habitat disturbance.

Therefore in various conditions the response of cursorial spiders to fire was different, being more evident in the first year after burning.

The effects of moderate land use on the plant biodiversity of different pannonian forest steppe mosaics

Tamás Rédei[1], Anikó Csecserits[1], Barbara Lhotsky[1], Csaba Molnár[1], József Nagy[2], Gábor Ónodi[1], László Somay[1], Katalin Szitár[1], Miklós Kertész[1]

redy@botanika.hu

1) MTA ÖK ÖBI, Alkotmány út 2-4, 2163 Vácrátót, Hungary
2) Corvinus University, Faculty of Horticultural Science, Villányi út 35-43, 1118 Budapest, Hungary

Three types of the Pannonian forest steppe vegetation were examined. Sand forest steppe of the Kiskunság region, dolomite forest steppe of the Transdanubian Mountains and foothill loess forest steppe of the North Hungarian Mountains. In each type 4 sampling areas were selected, 2 “sanctuaries” and 2 moderately used landsapes with an extent of 4 km2. Vegetation sampled 20x20m plots stratified systematically based on the vegetation types and the sapling areas. On the basis of the dataset we estimated the alpha, beta and gamma diversity of the sites based on the whole flora and also based on the selected pool of specialist species.
The response to the moderate use of the 3 forest steppe types were quite different. Loess vegetation was the most vulnerable in each species set and diversity types. On the dolomite, the share of specialists was reduced, but the vegetation resisted the invasion of alien species. On sand the species pool were limited also in the sanctuaries, however this type suffered the least loss of plant biodiversity.
Consequently the response of the forest steppe types to moderate disturbance depends on the substrate, namely the related habitat species pool.

Problems of Chalky Landscape Conservation in the North-East of Ukraine

Vladimir Ronkin, Lyubov G.Savchenko

ronkinvl@discover-ua.com

V. N. Karazin Kharkiv National University, Svobody sq. 4, Kharkiv, 61022, Ukraine

Chalky outcrops in Ukraine and Russia are sometimes characterized by unique vegetation cover, tomillares and thyme steppes. In northeastern Ukraine, such phytocoenoses occupy the hilly landscape on the right bank of the Oskol river. It is “Dvurechanskiy” National Nature Park created by biologists of Kharkov National University named after V.Karazin. Here we investigate phytocoenoses of chalky outcrops. Pioneers of pure creeping chalk are *Artemisia hololeuca, Matthiola fragrans, Thymus cretaceus, Hyssopus cretaceus* and other typical cretaceous species. The projective cover takes less than 10% in the beginning, with the number of species to 1 sq. meter varying from 6 to 8. Then, the projective cover increases to 15-20%, while the number of species per sq. meter grows to 8-10; *Hedysarum grandiflorum, Stipa capillata* can already be present in the grass canopy. The growth of *Thymus cretaceus*, *Helianthemum cretaceum* or *Hedysarum grandiflorum* content significantly increases thickness of the grass canopy, but decreases the presence of *Artemisia hololeuca*. Disappearance of *Matthiola fragrans* is simultaneously observed. The increased presence and prosperity of fabaceous *Hedysarum grandiflorum* or *Astragalus albicaulis* with additive of *Stipa capillata* (often *Salvia nutans*) indicates the initial stage of steppe sod development. The projective cover is 30-40%; the number of species per square meter is 10-15. True thyme steppe communities can be found at the richer soils areas. Their projective cover reaches from 35-50% to 100%, the number of species in such areas varies from 15-19 to over 30, but the diversity of typical cretaceous species is reduced, as such plants require soilless chalk that creeps. Thus, the areas with bare chalk-creeps are also necessary for preservation of biodiversity. Keeping these areas in the condition of creeping, soilless chalk remains one of the problems for chalky landscape conservation in the future.

Dynamics of extrazonal steppe and forest – steppe vegetation: afforestation and paragenese (Lake Baikal Region as an example)

Alexander Sizykh, Victor Voronin

alexander_sizykh@yahoo.com

Siberian Institute of Plant Physiology and Biochemistry RAS, Lermontova str. 132, 664033 Irkutsk, Russia

The present-day tendencies of vegetation development reflect a transitional character of the steppes of the coasts of Lake Baikal with tendencies of disappearing of a boundary between forest and steppe communities. Thereupon the problem of finding out the character of relationship between forest and steppe communities is brought to the task to determine a way and dynamics of climatic factors at local-regional level under the conditions of changing of the environment as a whole. Along with secular dynamics of taiga, when due to changes in the internal (edapho-cenotic) environment of phytocenoses, forest-forming species change, and there are other changes in the spatial structure of the communities. The presence of undergrowth and pine and larch saplings in steppe grass communities is indicative of trends toward a spatial expansion of tree ecobiomorphs in connection with an increase in yearly mean precipitation in the Baikal region for the last 30 years. There has been a reduction of areas occupied by steppe communities, and an active penetration of mesophytes into steppe coenoses. We have to notice here that activation of forest expansion onto steppe territory is mainly due to decrease of human impact, e.g., of use for grazing. We suppose that in this case there is paragenese, it corresponds to some degree to statements of some researchers. Their opinions are presented in the introduction of this very article. In our opinion, the vegetation paragenese in the environments contact area, in particular, one of Lake Baikal basin, is to be considered as manifestation of environmental conditions (relief structure, temperature and humidity dynamics) on a concrete territory. It can be presented at local (topological), regional (including basins of large water bodies and rivers) and continental levels of environment. The steppe and forest communities cover in this case serves as an indicator of the changing natural situation in the region. The vegetation in the environments contact areas is just the most evident paragenese manifestation. Phytocenoses diversity of first of all typological and classification importance is due just to paragenese. This phenomenon can serve as a base in the studies of plants species biology, of phytocenoses ecology, and of genesis of the whole environment. This would be reflected the formation of the environmental conditions for the period of relative warming, as was the case at different stages of the Holocene.

Origano-Brachypodietum pinnati Medw.-Korn. et Kornaś 1963 on the earthworks and castle ruins in the Western Carpathians

Donata Suder

donata.suder@uj.edu.pl

Jagiellonian University, Institute of Botany, Cracow, Poland

Origano-Brachypodietum pinnati Medw.-Korn. et Kornaś 1963 is a plant association classified within the Cirsio-Brachypodion pinnati alliance (Festuco-Brometea class), first described in the southern part of the Kraków-Częstochowa Upland. In the 1970s it was also indicated in the Pieniny Mts. Moreover, in other areas of southern Poland it is recorded more and more frequently (e.g. the Lublin Upland, Sandomierz Basin and Silesian Lowland). Origano-Brachypodietum association has still undetermined systematic position. Its connection with the communities of the thermophilous forb fringes of the class Trifolio-Geranietea sanguinei requires detailed research.

Phytosociological studies of 25 earthworks and 12 castle ruins in the Raba, Dunajec and Wisłoka river valleys (Western Carpathians) were carried out in 2009-2012. During the research 552 phytosociological relevés were taken. Among them 10 relevés represent the Origano-Brachypodietum pinnati association in various stages of secondary succession. On the studied objects patches of xerothermic plant community have developed in dry, sunny and hot sites, usually on the southern slopes of diverse steepness. This type of dry grassland prefers soil abundant in calcium carbonate. It is considered to be initial or degradative stage of xerothermic brushwoods. The community has lush, colorful and floristically rich character of flowery grasslands, with a large share of thermophilous and calciphilous dicots and *Brachypodium pinnatum*. This grass forms the uppermost vegetation layer (up to 1 m) and often occurs in extensive mats. Average height of the grassland sward ranges from 40 to 75 cm. In this layer abundantly grow e.g. *Agrimonia eupatoria*, *Clinopodium vulgare*, *Coronilla varia, Galium verum* and *Origanum vulgare*. In the phytosociological relevés on average 35-45 vascular plant species were recorded. Herb layer cover of studied grasslands was not complete (about 80-95%) and changes depending on the stage of succession. In certain sites even up to 15% of the area is occupied by rock rubble. There were also single trees, bushes and seedlings, passing from the adjacent shrubs belonging to Prunetalia order. Most of the patches of the Origano-Brachypodietum association that developed on the earthworks and castle ruins in the Western Carpathians are semi-natural and vulnerable to overgrowing.

Scientific work financed from the resources earmarked for science in years 2010–2013 as the Research Project No. N N305 062839.

Thermophilic and xerothermic flora of Lipowiec village and its surroundings (Roztocze Hills)

Sebastian Świerszcz[1], Grzegorz Swacha[2], Pawel Pech[3]

sebastian.swierszcz@up.wroc.pl

1) Wroclaw University of Environmental and Life Scien, Wrocław, Poland
2) Department of Biodiversity and Plant Cover Protection, University of Wroclaw, Kanonia 6/8, 50-328 Wrocław, Poland
3) Museum of Natural History, University of Wroclaw,Sienkiewicza 21, 50-335 Wrocław, Poland

Study area is located east of Lipowiec village in the southwestern part of Western Roztocze Hills. In the central and northern parts of the explored area numerous hills built of lithothamnium limestones and shell conglomerates are found whose elevation exceed 320 meters above sea level. In the western and southern part of the study area terrace of Gorajec river filled with quaternary sediments is present. The dominant types of soils are brown soils formed of cretaceous gaizes and in the lower parts rusty and podzol soils.
The study was conducted in 2011 and 2012 growing seasons and it was performed on the flora of non-forest communities. The study area comprised mostly arable lands and wastelands with a total area of ca. 300 hectares. The aim of the study was to investigate flora of thermophilic and xerothermic plant communities.
In total, 50 thermophilic and xerothermic plant species were recorded from the following classes: Festuco-Brometea, Koelerio glauce-Corynephoretea canescentis, Trifolio-Geranietea sanguinei, Rhamno-Prunetea. Two of them are under partial protection (*Helichrysum arenarium, Viburnum opulus*) and two others are listed in the red list of Lublin voivodeship with category of threat VU (*Teucrium chamaedrys*, *Rosa tomentosa*). The investigated area as well as adjacent terrains are poorly described in literature in terms of thermophilic and xerothermic vegetation. Interesting geological substratum and extensive agricultural management promote occurrence of many rare and protected plant species. Therefore, the area in question requires further botanical explorations.

A new seed weight database of the Pannonian flora

Katalin Tóth[1], Péter Török[1], Tamás Miglécz[1], Orsolya Valkó[1], András Kelemen[1], Ágnes Albert[1], Gábor Matus[2], Attila V. Molnár[2], Eszter Ruprecht[3], László Papp[4], Balázs Deák[5], Orsolya Horváth[2], Attila Takács[2], Bernadett Hüse[1], Béla Tóthmérész[1]

kissa0306@gmail.com

1) Department of Ecology, University of Debrecen, H-4010 Debrecen, PO Box 71, Hungary
2) Department of Botany, University of Debrecen, H-4010 Debrecen, PO Box 14, Hungary
3) Hungarian Department of Biology and Ecology, Babeş-Bolyai University, Hungary RO-400015 Cluj Napoca, Republicii street 42, Romania
4) Botanical Garden, University of Debrecen, H- 4010 Debrecen, PO Box 40, Hungary
5) Hortobágy National Park Directorate, H-4024, Debrecen, Sumen utca 2, Hungary

Plant trait based analysis became a frequently used method in ecological research in the last decade. Using physical characteristics of reproductive structures, like seed morphological attributes, is widely used in trait-based analysis. Several European electronic databases, including seed traits, have recently been built (like the Seed Information Database (SID), 7.1. of the Kew Botanical Garden, the Dispersal Diaspore Database or LEDA database). The use of these databases is limited in Central- and Eastern European countries because (i) most traits in these databases were measured on Western-European ecotypes and (ii) species with Eastern- and Southern-European distribution are often underrepresented. In our new database, original weight measurements are included for 1,405 taxa (with about 2,500 records in total). Out of these, there were 390 taxa of which the weight data were not recorded in the Kew Seed Information Database (accessed 15/12/2012), and for 409 taxa in LEDA (accessed 17/12/2012). For 198 taxa we give seed weight data for the first time. These species are mostly endemics and/or species with Pontic, Caspian or continental distribution. The seed weight data of dust-seeded species, especially orchids are generally very scattered in public databases. Our dataset provided seed weights for 30 terrestrial orchid species from which no data was formerly provided in international databases. Our database contains only a few aquatic plants, rare arable weeds, cultivated adventives and sub-Mediterranean species distributed in the South-Western part of Hungary. Problematic taxa, some difficult-to-harvest species and/or species with low seed production are also under-represented. The identified gaps underline the necessity of further seed collection and measure.

Xerophitic vegetation in central Podillya

Yuliya Vasheniyak

vasheniyak@mail.ru

State Inspection of Environmental Protection in Khmelnitskiy Region, I. Frank Str 2/2, 29010 Khmelnytskiy, Ukraine

Central Podillya includes different landscapes and plant communities of vegetation formed by the valleys of the Dnister River and the Pivdennyi Buh River. We have focused on dry grasslands because of their affective and rare status in Central Podillya. We have described dry grassland forest-edge, rupicolous and steppe communities in 2008-2012 and formed vegetation table based on our own and other authors' investigations. Vegatation databes were created in TURBOVEG and exported to JUICE. We have obtained the results and distinguished clusters by TWINSPAN.

Forest-edge vegetation is represented by Geranion sanguinei alliance (Ass. Trifolio-Melampyretum cristati, Peucedanetum cervariae, Campanulo bononiensis-Vicietum tenuifoliae, Geranio-Trifolietum alpestris, Inuletum salicinae) of Cl.Trifolio-Geranietea and Antherico ramosi-Geranietalia order. Rupicolous communities of Cl.Sedo-Scleranthetea are the most various in Central Podillya and grow on the south steep slopes on the psammozems, rankers and petrozems in the Dnister River and the Pivdennyi Buh River valleys. Communities on granitic rocks are combined in few orders: Sedo-Scleranthetalia order including Poo compressae-Rumicion acetosellae alliance (Ass.Sempervivo ruthenici-Sedetum ruprechtii), Festuco-Sedetalia order including Thymo pulegioides-Sedion sexangulare alliance (Ass. Thymo pulegioides-Sedetum, Artemisio austriaci-Teucrietum chamaedrys). Comunities on limestone rocks are combined in Alysso-Sedetalia order including Alysso alyssoides-Sedion albi alliance (Ass.Saxifrago tridactylito-Poetum compressae, Aurinio saxatilis-Allietum podolici, Ajugo chiae-Euphorbietum cyparissiciae, Minuartio thyraici-Teucrietum polii). Steppe vegetation is represented by Cl.Festuco-Brometea. Steppe communities grow on south and western-south slopes on rendzinas, chernozems and petrozems in the Dnister River valley. Steppe vegetation is represented by Festucetalia valesiaceae order including Festucion valesiacae alliance (Ass.Festuco rupicolae-Caricetum humilis, Festuco valesiacae-Stipetum capillatae, Koelerio macranthae-Stipetum joannis, Stipetum pulcherrimae, Melico transsilvanici-Stipetum capillatae), Artemisio marshaliiani-Elytrigion intermediae alliance (Ass.Salvio nemorosae-Elytrigietum intermediae); and Stipo pulcherrimae-Festucetalia pallentis order including Bromo-Festucion pallentis alliance (Ass.Poetum versicoloris, Lino hirsuti-Cleistogenetum bulgarici).

The diversity of vegetation on the protected areas of the Upper Don (Russia)

Elena Volkova[1], E.A. Averinova[2], E.M. Volkova[3], O.V. Burova[1]

convallaria@mail.ru

1) The State Museum-Preserve “The Kulikovo Field”, Tula, Russia
2) Bryansk State University, Bryansk, Russia
3) Tula State University, Tula, Russia

The Upper Don (Russia) is characterized by forest-steppe landscape. The location of steppe and broad-leaves forest communities on the boundary of different vegetation zones is a reason of their rareness. Many of the communities are protected.
The forest vegetation is represented by oak forests in the Don valley (protected area Tatinki, Afonichev, Razuvaev, Zinoviev forests, Zelionaya Dubrava); in the Sredniy Dubik valley (Skupoe, Repnoe I, Repnoe II, Polugar’); the ravine forests of Nizhniy Dubik valley. The total area of forest massives is about 137 ha. The most common association is Lathyro pisiformis–Quercetum roboris, which combines the xeromesophitic broad-leaved oak forests with steppe and forest-steppe floristic components. The association is presented by 3 variants, 1 subassociation and 1 facies. Some mostly transformed plant communities do not have any syntaxonomical status («no rank» communities): Prunus spinosa–Quercus robur, Bromopsis inermis–Quercus robur, Carex pilosa–Quercus robur, Padus avium–Quercus robur, Fragaria moschata–Quercus robur; Poa angustifolia–Betula pendula. They are the stages of restoration of natural forest. The richest phytocenotic diversity is typical for the forests of Sredniy Dubik area (1 ass., 4 communities). The poorest vegetation was described in Tatinki and Zelionaya Dubrava.
Herbaceous vegetation on the steppe slopes was examined on the following protected areas: Nizhniy Dubik, Sredniy Dubik, Tatinki, Ryhotka, Sebino (total area - 87 ha). Steppe vegetation is presented by ass. Gentiano cruciatae–Stipetum pennatae (3 subass.) and ass. Stachyo rectae–Echinopetum ruthenici (2 subass., 2 variants). The most varied steppe vegetation is typical for Sredniy Dubik area (2 subass.). The Ryhotka area is presented by ass. Stachyo–Echinopetum (var. *Astragalus onobrychis*), the Sebino area is characterized by *Galium verum* community.
However, the Upper Don is characterized by steppe and forest vegetation which is influenced by human “pressure”. The classification of vegetation and the floristic data of protected areas will be used for environmental monitoring of vegetation of the Upper Don territory.

Dry grasslands of the Ingul river valley (Ukraine): syntaxonomy, anthropogenic dynamics and conservation

Denys Vynokurov

phytosocio@ukr.net

M.G. Kholodny Institute of Botany of the NAS of Ukraine, Tereshchenkivska str. 2, 01601 Kyiv, Ukraine

Ingul river is located almost entirely in the steppe zone of Ukraine. Dry grasslands communities are represented on the slopes of the valley and the surrounding upland unplowed areas.
We have collected 335 geobotanical relevés in Turboveg database. For comparison, relevés from other regions of Ukraine and neighboring European countries (Moldova, Romania, Bulgaria, Hungary, Slovakia, Czech Republic, Russia) have also been added to the database. All data has been analyzed by Juice 7.0, using the Modified Twinspan Classification.
It was found that dry grasslands of the Ingul river valley are represented by 11 associations and 3 communities, combined into 6 alliances, 6 orders and 4 classes. Communities of sandy steppes are represented by Festucetea vaginatae class in the lower reaches of the Ingul valley. On silicate outcrops in the middle reaches of the river grow cenoses of the cl. Koelerio-Corynephoretea, on limestone outcrops in the lower reaches of the river – cenoses of Helianthemo-Thymetea (as a preliminary). The class Festuco-Brometea, which is represented by 3 alliances and 9 associations, has the greatest syntaxonomical diversity.
It was revealed that the leading factors of the anthropogenic transformation of the dry grassland communities are pasturing, post-pasturing, recreational and post-plowing impacts. The least resistant to disturbance are Stipion lessingianae communities, most resistant – Artemisio-Kochion prostratae communities.
Steppe vegetation has high diversity of the rare phytocoenoses – in the Green Data Book of Ukraine are included 12 “formations” of vegetation. There is a significant number of rare species in the dry grassland communities also (Red Data Book of Ukraine – 31, IUCN – 8, European Red List – 18 species).
For biodiversity conservation creation of 5 objects of natural reserve fund is proposed. Also, a scheme of regional ecological network of the valley is developed and main ways of its integration into a national econet of Ukraine. It includes 19 key territories (4 - regional, 15 - local level). To optimize the efficiency of econet it is important to create two additional local ecological corridors along the Ingul river. Establishment of ecological network will contribute to stabilization of the environment situation in the region, restoration of biodiversity, supporting the hydrological regime, reducing soil erosion etc.

Cryopreservation of *Carlina onopordifolia* Bess. – Community important, Polish-Ukrainian narrow endemic and wandering Tertiary relic species

Piotr Walerowski[1], Jerzy Puchalski[1], Wiesław Podyma[1], Adam Kapler[1], Maciej Niemczyk[1], Antoni Krzyżewski[1], Arkadiusz Nowak[2], Agata Smieja[3]

piotr.walerowski@gmail.com

1) PAS Botanical Garden – Center for Biological Diversity Conservation, Prawdziwka 2, 02-973 Warsaw, Poland
2) Laboratory of Geobotany and Plant Conservation, Department of Biosystematics, Opole University, Oleska 48, 45-052 Opole, Poland
3) Silesian Botanic Garden, Sosnowa 5, 43-190 Mikołów, Poland

Carlina onopordifolia Bess. belongs to the group of Community Important species. It is listed at: Annex II and IV of Habitat Directive, the Bern Convention and IUCN Red List as vulnerable. It is a steppe plant, typical for Inuletum ensifoliae association, endemic to SW Ukraine (Volhynia and Podolia plateaus) and SE Poland (Lublin and Małopolska uplands), a wandering Tertiary relic and one of few hapaxanths (long-living, monocarpic perennials) among native European flora, closely related to Mediterranean species from this genus from the subgenus Heracantha, like ornamental *C. acanthifolia* All.
At Powsin Seed Bank we investigated germination and cryopreservation of this critically endangered element of our native flora. Seeds of *C. onopordifolia* were obtained at "Skowronno" nature reserve and then tested at Powsin Seed Bank laboratory. It has been proved that they do not exhibit seed dormancy. Cryoconservation at liquid nitrogen is relatively easy. New samples of *C. onopordiolia*diversity from "Stawska Góra" nature sanctuary and Natura 2000 site will be secured by MCSU BG and Powsin Seed Bank staff in the framework of new, "Natural populations evaluation and ex situ conservation of wild and threatened plant species in Poland - ROBiA FlorNatur" project.
Ex situ collections of *C. onopordifolia* germplasm at seed banks can become a valuable source of new specimens to strengthen the declining natural populations and/or to create more substitute sites of this rare plant.

Xerothermic communities in selected habitats of Natura 2000 areas in the Zamość region

Teresa Wyłupek

teresawylupek@op.pl

University of Life Sciences in Lublin, Faculty of Agricultural Sciences, ul. Szczebrzeska 102, 22-400 Zamość, Poland

The objective of this study is to estimate the floristic diversity of selected plant communities in dry habitats located in Natura 2000 areas in the Lublin Province.
The studies encompassed communities located in Krasnobrodzki Landscape Park (PLB 060012 Roztocze) and limestone hills in the village of Niedzielska (PLH 060044 Niedzieliska).
Phytosociological relevés according to the Braun-Blanquet method were taken in the above areas in the years 2011-2012. The species terminology conforms to the study by Mirek et al. [2002] while the names of syntaxa and species characteristic of the particular units are based on Matuszkiewicz [2006].
In the stony rendzina in the utilised arable fields within the Natura 2000 area (Niedzieliska PLH 060044), phytocenoses were distinguished and included in the Festuco-Brometea class of the Festucetalia valesiacae complex. The plots analysed, located on an undulating slope with a SW exposure, have been used agriculturally for over 20 years. The sward density in most of the plot area ranged from 50 to 80%. A considerable floristic diversity included species under strict protection, e.g. *Anemone sylvestris* and *Gymnadenia conopsea*.
In the selected area of Krasnobrodzki Landscape Park (PLB060012 Roztocze), phytocenoses were distinguished and included, based on Matuszkiewicz, in the Nardo-Callunetea class. The following taxa characteristic of this class occurred among the species identified: *Sieglingia decumbens, Hieracium pilosella, Luzula campestris, Potentilla erecta*. Furthermore, taxa of the Arrhenatheretalia order were found. The analysed habitat is excessively dry and characterised by loose mineral deposits, moderate sward density of about 70% and moss density of about 30%.

Thermophilic plant communities in Natura 2000 site "Łąki nad Wojkówką" PLH 180051 – Podkarpacie Province

Maria Ziaja, Tomasz Wójcik

mziaja@univ.rzeszow.pl

Rzeszów University, Department of Natural Sciences, Section of Ecology and Nature Conservation, Rzeszów, Poland

Xerothermic grasslands are among the most valuable and, at the same time, the most vulnerable elements of the natural environment of Poland. In Podkarpacie Province there is a certain number of dry grassland locations, mainly in and around Przemyśl, whereas in other parts of the province they are sporadic and only partially developed. Especially interesting are the meadows around the villages of Wojkówka, Rzepnik and Odrzykoń, where small patches developed of thermophilous grasslands, rarely represented in Jasło-Sanok Valleys and Dynów Foothills. It is in order to protect these that a Natura 2000 site "Łąki nad Wojkówką" PLH 180051 was created, comprising three grassland-meadow complexes preserved on the slopes of small hills on the Wisłok river valley.

The aim of the research was to provide a phytosociological characterictics of the thermophilous grasslands, their distribution and threats as well as the prospects for conservation of the communities.

On the study area a significant share belongs to the communities with species characteristic of the Festuco-Brometea class (e.g.: *Salvia verticillata, Centaurea scabiosa, Melampyrum arvense, Viola rupestris*). Lack of lower syntaxonomic units does not allow for them to be classified as a phytocoenosis. Associations dominated by species from the Molinio-Arrhenateretea class were also recorded, on the basis of which a thermophilous variant of the community was distinguished. The transient nature of the phytocoenoses results from the specifics of the habitat and methods of utilization.

In consequence of land abandonment some patches were dominated by shrubs from Rhamno-Prunetea class, in which a presence of the following species can be noted: *Cornus sanguinea, Crataegus monogyna, Ligustrum vulgare, Prunus spinosa*.

The main threat to the existence of xerothermic grasslands is secondary succession, caused by abandonment of traditional farming methods. The expansion of shrubs typical for the Rhamno-Prunetea class results in changes in habitat conditions and therefore causes the thermo-and photophilous species to retreat. Maintaining and preserving of the floristic richness of the sites requires active protection measures which involve restoration of former utilizing methods such as grazing, mowing and controlled burning.

Dry grasslands in Jászság, plain micro-region in Hungary (Panonic sand steppes, loess steppic grassland, salt steppes and salt marshes)

Zsuzsa Tóth, János György Nagy

toth.zsuzsa@mkk.szie.hu

Institute of Botany and Ecophysiology, Szent István University, Páter Károly Street 1, H-2103, Gödöllö, Hungary

The Jászság micro-region is located in the eastern part of the Hungarian Great Plain, its area is 701 km² on which semi-natural vegetation can develop. The objects of our survey are flora, vegetation and habitats of the micro-region. Today more than 85 % of territory of the Jászság is occupied by arable lands, mostly used by agriculture and forestry. In the past, these areas were covered by Zagyva-, Tarna-river and their wetlands. After river control in 18-20th century shaped micro-region's current habitats types, it was heavily fragmented.

The Pannonic sand steppes's plant communities in Jászság are Festucetum vaginatae with *Dianthus serotinus, Stipa borysthenica, Stipa capillata, Agropyron cristatum*, Pannonic sand steppes habitat with plant community Astragalo austriacae-Festucetum sulcatae, a rare protected plant in Jászság is *Pulsatilla pratensis* ssp. *nigricans*. These habitats can be found in locations of old orchards, vineyards, plantations of *Populus* spp., *Pinus nigra, Pinus sylvestris.*

Pannonic loess steppic grassland with the community Salvio nemorosae-Festucaetum rupicolae with *Amygdalus nana*, numerous *Ornithogalum pyramidale and Bromus pannonicus* occur near public road in borderlines Along the dam of Zagyva river *Clematis integrifolia* and rarely *Phlomis tuberosa* can be found.

Halophytic habitats such as Artemisia salt steppes, the association Artemisio santonici-Festucetum pseudovinae and high fragmented Limonium-Artemisietum belong to Natura 2000 areas and these have the largest cover. There are also Achillea steppes on meadow solonetz, mostly Achilleo setaceae-Festucetum pseudovinae, besides this in a little part Inulo-Festucetum pseudovinae can be observed.

Biogeography of calcareous xerothermic grasslands in Poland: unexpected patterns

Mihał Żmihorski[1], Katarzyna Barańska[2], Łukasz Kajtoch[3]

zmihorski@miiz.waw.pl

1) Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw, Poland
2) Klub Przyrodników, 1 Maja 22, 66-200 Świebodzin, Poland
3) Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland

We compared species composition of calcareous xerothermic grasslands located in three termophilous flora hotspots in Poland: the Odra region, the Lower Vistula region and the Upper Vistula region. In total we included data for 154 plots (67 Festuco-Stipion alliance and 87 Cirsio-Brachypodion-pinnati alliance grasslands), 25m2 each, where vegetation was mapped and coverage of all species assessed. We recorded that rarefied species diversity of the alliances was the highest in the Upper Vistula while the lowest in the Odra, and this pattern persists for both Festuco-Stipion and Cirsio-Brachypodion. Xerothermic plant communities were significantly more similar between the two river valleys than within one river valley: grasslands from the Odra and the Upper Vistula as well as from the Odra and the Lower Vistula were significantly more similar than grasslands from the Upper and Lower Vistula. The pattern was confirmed for both Festuco-Stipion and Cirsio-Brachypodion grasslands. This pattern is in contradiction to the hitherto prevailing opinion that migration routes of xerothermic species followed river valleys. On the other hand to some extent it is supported by limited data about phylogeography of xerothermic plants and beetles. Further research is needed to resolve the problem.

Grassland vegetation in the Borská nížina lowland, Slovakia

Katarína Hegedüšová, Iveta Škodová

katarina.hegedusova@savba.sk

Slovak Academy of Sciences, Institute of Botany, Dúbravská cesta 9, 845 23 Bratislava, Slovak Republic

Borská nížina lowland is situated in the south-western part of Slovakia. This smallest lowland in Slovakia with specific natural conditions is a part of the region Záhorská nížina Lowland. It borders with Austria and the Czech Republic, and belongs to a warm climatic zone with uneven occurrence of rainfalls. Phytogeographically, the area belongs to the region of pannonian flora (Pannonicum) of the Záhorie district comprising a zone of the eupannonian xerotherm flora (Eupannonicum). In our research, we focused on classification of the vegetation units in the Borská nížina lowland. Phytosociological relevés were recorded in the years 2003–2004 according to Zurrich-Montpellier school. The remaining data set contained 177 relevés with 447 species. The internal variation within the dataset was assessed by numerical classification using the relative Euclidean distance as a distance measure and Ward's group linkage method on logarithmically transformed species data (PC-ORD 5.0 software package; McCune & Grace, 2002). Diagnostic, constant and dominant species for the clusters were calculated by JUICE (Tichý 2002). Diagnostic species were statistically determined on the base of fidelity concept (Chytrý et al. 2002, 2006) using the phi coefficient $\Phi \geq 0.25$. Fisher's exact test ($P < 0.001$) was used to eliminate the species with a non-significant pattern of occurrence. Following the numerical classification ten floristically differentiated vegetation units were distinguished within the data set and assigned to the three phytosociological classes: Phragmito-Magnocaricetea, Koelerio-Corynephoretea and Molinio-Arrhenatheretea. The relationship between species composition and defined environmental factors was analysed by the detrended correspondence analysis (DCA) using the CANOCO 4.5 package (ter Braak & Šmilauer 2002). The results of DCA support our assumption that the major environmental gradients in species composition of vegetation were associated with moisture, nutrient content and temperature following the average Ellenberg indicator values. Distribution of the relevés shows a continuous ecological transition among the associations from the communities on the warmest sites with high solar irradiation and shallow acidic sandy soils free of calcium carbonate, with very low humus content and low nutrient status (Corynephorion canescentis alliance), to the marshland communities spread on the wet meadows, whose habitats are flooded for most of the year (Galio palustris-Caricetum ripariae association). The communities of Phragmitetnum communis association prefer the most nutrient rich soils. The communities of the Molinion alliance have intermediate character, which is due to its species composition conditioned by common occurrence of the mesophilous and hygrophilous species.

Acknowledgements: The authors were supported by the Science Grant Agency of the Slovak Academy of Sciences (VEGA 2/0099/13).

Pioneer grassland vegetation of sand dunes in the Western Bug basin (Ukraine)

Borsukevych Liubov

lborsukiewicz@gmail.com

Botanical Garden of Ivan Franco National University of Lviv, Cheremshyna St. 44, Lviv 79014, Ukraine

Western Bug is the biggest river of the lowland part of Western Ukraine, which belongs to the Baltic Sea basin and is a transboundary watercourse (363 km) within the territory of three countries: Ukraine, Poland and Belarus.

This research has been done within the frame of the BBI-MATRA project "Integration of the Western Bug Basin in the Pan-european Econet "NATURA 2000". The aim of our study was to make an inventory and mapping of rare and endangered habitats occurring in the basin according to the Directive of European Union 92/43/ECC. As a result we have detected 26 natural habitat types of community interest. One of them is 'Inland dunes with open Corynephorus and Agrostis grasslands' habitat type (code 2330).

The studied communities are mostly dominated by *Corynephorus canescens*. They belong to Koelerio-Corynephoretea class and are classified in one alliance Corynephorion canescentis, which includes only one association Corniculato aculeatae-Corynephoretum canescentis.

The distribution range of the Corynephorion canescentis includes temperate Europe from East Anglia to Ukraine, however the alliance is most common and floristically/phytocoenotically rich in areas with suboceanic climate. In Ukraine it is on the eastern border of distribution and occurs only in the western part, on the sand dunes, which are very rare type of ecotope here. Therefore these communities have a lack of some diagnostic species here, are endangered and need protection.

This association is typical for acidic sand dunes free of calcium carbonate, with very low humus content and low nutrient status. It is disturbed by redistribution of sand, and by human activities such as forest clearings and sand pits.

The communities are characterized by low species composition. There are on the average 10-19 species of vascular plants and 2-5 species of bryophytes and lichens with total cover 40-60% on the 16 m2 plots. Some of the psammophilous species (*Corynephorus canescens, Agrostis capillaris, Rumex acetosella, Thymus serpyllum, Hieracium pilosella*,) belong to the group of species with high constancy.

The main threats for the communities are the appearance of succession communities of shrub and tree species, mining of sand, illegal waste dumps, use of different chemical agents.

Traditional methods of management are recurrent disturbance at an interval of every few years, cutting of trees. It is necessary for this vegetation type to persist and to prevent succession towards closed grassland.

Black Lands preserve as reservation of arid European arid landscapes

Vladimir Aushev

aushev-vladimir@bk.ru

Kalmyk State University, Pushkin Str. 11, 358000 Elista, Republic of Kalmykia, Russia

The object of our research is preserve «Black Lands». This is the only nature reserve, situated in the arid zone of the European continent. In 1993 it was included into the network of biosphere preserves of the world. The purpose of its research is the conservation of Kalmyk saiga population, ecosystems restoration prognosis working out after long anthropogenic influence. At the end of the 20-th century the overloading of Chernozemel pastures by livestock has created uneven sand-hilly relief here. The amount of degraded lands was 96. 2 %, from them on the stage of strong and very strong desertification is 56. 1 %, corresponding to the zone of ecological catastrophe [1].

At present these lands are the area of devastative processes, indicator of which is vegetation. Research was made in 2012 on the plots, situated in the western and south-western part of the preserve. It was defined that there are commonly expanded associations with the domination of *Stipa sareptana*, *Agropyron fragile, Achillea gerbera* and *Artemisia lerchianasabulosa*, the number of ephemers, ephemeroids and annuals is insignificant and with the absolute absence of cattle-grazing. The relief gradually changed from sand hilly and uneven to little uneven. Restorational process is directed to the formation of sand variants of desertificated steppes in the vegetation cover of the preserve. Geobotanic descriptions show that species composition on the top of sand-hills include 10-14 species, the dominants are psammophiles of the 1-st order: *Leymus racemosus, Calligonum aphyllum*, on the slopes there are psammophites of the 2-nd order (*Artemisia arenaria*, *Festuca beckerii*), but at the foot there are hemipsammophites (*Agropyron fragile, Artemisia lerchianasabulosa, Stipa sareptana*).

The main reason of devastative processes in vegetation cover of Chernozemel pastures, is connected, in our opinion, with climatic cycle change, which is due to humidity increase of sandy soils, the absence of cattle pasture has even hastened the restoration of vegetation cover. In connection with this fact weak class of desertification dominate on the preserve territory at present. However, long droughts, dry winds, dust winds can again cause the movements of sands.

Xeric forest-grassland mosaics in southern Hungary: flora, vegetation and ecology

Zoltán Bátori, László Erdos

zbatory@gmail.com

Department of Ecology, University of Szeged, Szeged, Hungary

We studied the forest interiors (Populocanescenti-Quercetumroboris), the grasslands (mainly Festucetumvaginatae) and the edges of natural xeric forest-steppe mosaic complexes of the wooded-steppe in Hungary. Many stands of these associations became extinct in Hungary in the twentieth century; their remnants are acutely threatened. In order to reveal the vegetation patterns, 2 m × 1 m plots were established within the three habitat types (forest, grassland and edge) and percent cover of each vascular plant species was estimated. We employed wireless sensor motes equipped with air temperature and humidity sensors to measure the microclimatic differences between the habitats. Species composition, species richness, Shannon diversity and diagnostic species were determined and compared between the different vegetation types. Considering species composition, we found that forest edges differ both from forest interiors and grasslands, forming a narrow but species rich habitat harbouring many rare and protected species. The forest patches are primarily composed of closed sandy grassland species, indifferent species and mesic forest species, while edges are dominated by closed sandy grassland species. The xeric grasslands are dominated by open sandy grassland species. Shannon-diversity was higher within edges than in either of the neighbouring habitat interiors. The distance-based redundancy analysis revealed that vegetation pattern is significantly influenced by the elements of microclimate, mostly by the mean daytime air temperature and mean daytime air humidity. We can conclude that the remnants of xeric forest-grassland mosaics in southern Hungary have a high nature conservation value. All of their components are integral parts of wooded-steppes.

Response of Crimean dry grassland community structure and production to change in precipitation: first results of manipulative study

Olga Kuzmanenko[1], Yakiv Didukh[2]

ceol@yandex.ru

1) National University of Kyiv-Mohyla Academy, Department of Ecology, Skovorody str. 2, off. 3-208, 04655 Kyiv, Ukraine
2) M.G. Kholodny Institute of Botany NAS of Ukraine, Department of Phytosystem Ecology and Geobotany, Tereschenkivska str. 2, 01601 Kyiv, Ukraine

Dry grasslands are some of the most vulnerable, nonresistant, and dynamic ecosystems; thus, they demand special protection measures that are not easy to provide. Even if conservation and management activities are relevant, dry grasslands may change under indirect influences, such as climate-driven change in hydrological regime. To predict such change, there is a strong need of experimental data. Since 2011 we have been conducting the experiment to study the response of dry grassland community (*Eryngio-Stipetumponticae* Didukh 1983, *Festuco-Brometea*) to manipulative alteration of precipitation (PPT) levels (increase and decrease on 20, 40, and 60% from the ambient level) in Karadag nature reserve (N44°54.914'; E050°12.289'). After a year of experiment, aboveground net primary production showed a positive correlation with PPT ($r=0.65$, $p<0.01$), varying from 47.9±7.3 g C $m^{-2}y^{-1}$("-60%") to 109.47±0.24 g C $m^{-2}y^{-1}$("+60%"); for the belowground net primary production we observed no consistent relationship. The average height of vegetation at "+60%" plots appeared to be 40% higher than at control. Yearly change in species' presence/absence per plot showed a positive correlation with PPT for *Lathyrus sphaericus* ($r=0.87$ $p<0.05$) and *Veronica hederifolia* ($r=0.7$, $p<0.05$) and, thereby, a tendency to appear at plots with added PPT and, respectively, to avoid "dry" plots. *Lathyrus aphaca* ($r=-0.87$, $p<0.05$) demonstrated an opposite tendency. All of them are vernal annuals, which are able, due to their short life cycle, to respond quickly to changes in environment and may be used as indicators. The yearly change of species frequency index showed a positive correlation with PPT for perennials *Dactylis hispanica* ($r=0.42$, $p<0.1$) and *Falcaria vulgaris* ($r=0.46$, $p<0.05$). In general,during the first year the community structure did not change significantly, which can be explained by "lag effect" widely discussed in literature. Moreover, the indirect measurements of soil moisture performed with use of synphytoindication method (Didukh, 2011) showed no significant difference between the plots (although in fact it was) that can also confirm the lag effect. The manipulative experiments of such type may be considered as important data source for predicting possible behavior of dry grasslands facing changing climate, as they allow to obtain results more rapidly than in natural conditions and, thus, to select the appropriate conservation and mitigation measures for targeted ecosystems.

European semi-desert vegetation and its present status

Viktoria Lazareva

lazareva-vg@yandex.ru

Kalmyk State University, Pushkin Str. 11, 358000 Elista, Republic of Kalmykia, Russia

The territory of Kalmyk Republic is situated in the extreme South-East of Europe, representing the most arid part of the continent. Its geographical position, geological past formed semi desert nature of soil-vegetation cover, steppes dominate in the west, in the east there are steppe deserts. Steppe zone of Kalmykia involve three subzones: real, dry and desertificated. The first two are confined to Manych valley and are the borders between European and Asian continents. They belong to the Black Sea province occupying about 10% of Kalmyk area.

Desertificated steppe within the range of the republic occupies about 40% of its territory and comprises Zavolzhsko-Kazakhstan province. According to mechanical composition of soils we identify four ecological variants: xerophite, hemipsammophyte, psammophyte and halopsammophyte [2].Their indicators are species of Stipa, Agropyron genera. Xerophyte variant grows on light-brown soils of Yergeny elevation and Sarpinsky lowland, the dominant species is *Stipa lessingiana*. Hemipsammophyte steppe occurs in the Southern and South-Eastern part of the Precaspian area on the sandy loams and loamy soils, the dominant is *Stipa sareptana*, the third – one is on the sandy soils of the same part of the region. Halopsammophyte variant is presented by salty sands of the sea shore [1].

The Precaspian lowland occupies most of the Republic area and is situated between Volga-Akchtuba water meadow, Ergeny, river Kuma valley. This is a young sea plain, gradually lowering to the coast of the Caspian sea. Vegetation cover belongs to Afro-Asian desert region of the North-Turanian province. Here we define: haloxerophyte and xerophyte variants of semi-shrut deserts. The first one is the subdominant of desert, faceted steppes in the Sarpinsky lowland. Dominant haloxerophyte is *Artemisia pauciflora*. The second variant dominates on the medium saline land of Central part of Precaspian lowland, the dominant species is *Artemisia lerchiana*. A characteristic peculiarity of zone vegetation is complexity. It has 4-5 members and is clearly expressed on loamy soils and it has 2-3 members on sandy loams and light loams. Interzonal vegetation in Kalmykia is represented by meadows, flooded area , sand vegetation and salines.

Synecology of Dutch dry levee grasslands

Suzanne Rotthier

suzanne.rotthier@wur.nl

Wageningen University, Droevendaalsesteeg 3, 6708PB Wageningen, Netherlands

Surface area and quality of dry levee grasslands have declined in the Netherlands since the 1950's. To understand the current situation of the remaining dry levee grasslands we classified relevés from seven different localities along the four main rivers of the Netherlands where high quality levee grasslands still occur. The communities were named according to the national overview of plant communities and species composition was related to both soil characteristics and inundation with multivariate analysis. Each locality appeared to represent different conditions with different levee communities. Per community the ecological amplitude is shown as the range of each soil property, which is represented in boxplots. The main variation in species composition appears to be related to Calcium, pH0.2MKCl extract, cation exchange capacity, CaCO3, coarse sand (0.5-1mm), N, C, Organic matter, P and Mg. The second axis is best explained by the variables: very fine sand (50-106µm), soil fraction with particles <50µm, and mineral-N.

On dynamic sites, with sand deposition, the vegetation could be assigned to the pioneer communities Echio-Verbascetum and Bromo-Eryngietum. These communities are clearly distinct from the remaining communities from less dynamic sites. Within the more stable grasslands the Festuco-Thymetumserpylli and Sedo-Thymetumornithopodetosum differed considerably from the other stable communities. They grow on the most nutrient poor and relatively acid, most coarse grained sand. The Medicagini-Avenetum was related to more nutrients, higher cation exchange capacity, and very fine sand. Differences in species composition between the dry levee grassland communities was not explained by flooding duration (calculated in number of days). Differences in inundation distinguish the dry levee grasslands from other communities.

In order to compare the synecology of the Dutch dry levee grasslands to those in other European countries a field survey is planned to Germany, Latvia and Lithuania.

Xerothermic herb communities of the alliance Geranion sanguinei, class Trifolio-Geranietea sanguinei Th. Müller 1962 as a symptom of secondary succession of dry grasslands

Tomasz Szygendowski

szygend@gmail.com

Adam Mickiewicz University, Poznań, Poland

Most xerothermic grasslands in Central and Western Europe are subject to secondary succession, which stems from their semi-natural character. Formation of xerothermophilous herb communities of the alliance Geranion sanguinei, order Origanetalia vulgaris, class Trifolio-Geranietea sanguinei, first recorded by Th. Müller in 1962 in Germany, can be recognized as one of the primary indicators of this process. In Poland however, until recently, phytocoenoses of aforementioned type have been poorly examined. The aim of this paper is: 1) to characterize the associations of the alliance Geranion sanguinei, listed in course of Author's recent (2012) study, 2) to compare the results of study mentioned above with the one carried out at the same site 20 years ago - in order to analyze the secondary succession process and 3) to refer to the data gathered during the 2011 research on communities of the class Trifolio-Geranietea, made by A. Brzeg and S. Wika.

The Autor's study site is the Murawy Dobromierskie nature reserve, located in Przedbórz Upland macroregion, South-Central Poland. There were made 59 relevés in total, 40 of which accounted for phytocoenoses of the all. Geranion. 6 relevés representing Peucedanetum cervariae, 5 and 3 rel. representing Geranio-Anemonetum sylvestris and Lathyro-Vincetoxicetum, respectively, were chosen for comparative analysis.
In 1993 the Conservation Plan of the nature reserve was drawn up, R. Olaczek being the author of the vegetation phytosociological diagnosis. Examination totaled in the number of 21 relevés, most of which (14) were represented by only one association – Thalictro-Salvietum pratensis. All these relevés are subject to comparison with chosen ones mentioned before, made by Author in similar locations.
In 2011 there was research conducted by A. Brzeg and S. Wika on xerothermic herb communities of the Kraków-Częstochowa Upland macroregion. Out of 432 relevés made in total, 143 represent associations of the all. Geranion sanguinei , and 11 are singled out for comparative analysis.
Reléves representing compared sites are arranged in synthetic phytosociological tables.

Xerothermic herb communities, despite triggering more advanced succession stages of dry grasslands, contribute to ecosystems' biodiversity and often themselves constitute optimal habitats for rare and protected plant species. Therefore, an issue of protection of both types of phytocoenoses at their common sites is also to be discussed.

Presence of chalky slopes - one of key factors in maintaining the MARMOT (*MARMOTA BOBAK* MULL.)

Nadia Tokarskaya

adskii_tigrusik@mail.ru

Metrostroitelei 5 flat 2, Kharkov 57, Ukraine

In the pool Siverskii Donec a special place is occupied by vegetation of the chalky baring. Crystalline foundation that beds on a depth 1-2 kilometres, recovered by the fallouts removing layer by layer of different power. Mesozoic layers are represented by trias, jurassic and chalky sedimentations. Similar geobiocenoses occupy small areas in Northeastern Ukraine and also in a few adherent areas of Russia, but are not present in other countries of Europe. Lately a question arises about maintenance of original chalky flora and vegetation in East Ukraine and how it plays a considerable role in maintenance of precinctive flora and fauna.
Until the beginning of 21st century marmots occupied flood-lands and chalky slopes of the river Oskol. Its population was 3-4 individuals on 1 ha. Presently there is a sharp decline in the number of individuals of this species. After abandonment of cattle pasturage and the change of structure of vegetation of flood-lands there has been a severe reduction of families of steppe marmot. So on the stretch from r.Topoli to r.Novomlinsk in the end of 20th century on chalky slopes and flood-lands of the Oskol 375 families dwelt, and already in 2005 there are only 57 families. The same picture occurs on the right bank Wolfish to the Kharkov region, river Aidar and White in the Luhansk region Ukraine and river Aidar to the Belgorod region of Russia. The remaining domestic areas are mainly noncommunicative on the border of chalky mountains and flood-lands. The presence of chalky slopes positively affects the population of steppe marmot and in some districts their presence is one of key factors in its maintenance.

Vegetation boundary dynamics of a Hungarian dry grassland

Csaba Tölgyesi, László Körmöczi, Márta Zalatnai

festuca7@yahoo.com

Department of Ecology, University of Szeged, 52 Középfasor, H-6726 Szeged, Hungary

Vegetation boundaries are structural and functional components of the landscape. Although several studies have been conducted on boundary structure and background factors, little is known of their temporal dynamics. In the present study a long (55m×1m) and a short (30m×1m) permanent belt transect located on a Hungarian grassland was surveyed in every spring and fall in 1999-2012 and 2003-2007, respectively. The study area constitutes of small sand dunes and hollows covered with patchy vegetation with mesic stands in the hollows and more xeric ones towards the hilltops. Vegetation boundaries were identified with the moving split window technique. The boundary profile of the long transect consisted of three major boundaries. They were present throughout several years and were constant in location. In spring, the first boundary was detectable in all years but in 2009; the second one was present only in 2000-2003/2005 and the third one appeared first in 2004 and remained detectable during the rest of the study. Fall data followed the same pattern, though there were more years when boundaries could not be detected. Three constant boundaries could be found along the short transect as well. Spring and fall data were similarly consistent. The three boundaries could be detected in 2003/2006-2007 in spring and in 2003/2005 in fall; in 2003/2006-2007 in spring and in 2003-2006 in fall; and in 2004-2007 in spring and in 2003-2005 in fall, respectively. We conclude that the primary feature of the dynamics of these boundaries is not lateral movement but disappearance and (re)appearance at constant sites. These sites must have invariable microclimatic properties that can be traced back to the relief. Without specifying these factors, we can state that boundary sites can exist without manifest vegetation boundaries in certain time points (i.e. potential boundaries), while other, constant-looking vegetation boundaries may disappear in the future with the potential to reappear once again at the very same site. This implies that an effective strategy to conserve the natural values represented by boundaries within patchy habitats (1) should find a way to identify boundary sites lacking manifest vegetation boundaries and should also involve these in the conservation plans, but (2) manifest vegetation boundaries should not be maintained by all means as their disappearance may be part of the natural dynamics of the landscape.

Arid lands desertification dynamics of the european continent

Valentina Bananova

bananova_va@kalmsu.ru

Kalmyk State University, Pushkin Str. 11, 358000 Elista, Republic of Kalmykia, Russia

Desertification is the most urgent problem nowadays. It has become global in arid zones of the planet (1). These lands are concentrated within the range of Russian Precaspian area, where The Republic of Kalmykia embraces more than 80 per cent of the territory in the extreme south-west of Europe.

Most scientists define desertification as a degradation process of arid ecosystems under the influence of natural and anthropogenic factors. Among the first one there dominate the consequences of the Caspian sea level rise. According to UNEP data (1995) there are more than 700 thousand hectares of agricultural lands in Precaspian area, where 60 populated localities were swamped. Available field geobotanical material, having been collected for the last 30 years allowed to work out and publish the map «Anthropogenic desertification in Kalmyk Republic» (1989) and mark three degradation types: biogenic, biogenic-technogenic and technogenic, taking place during that period 64.0%:12.3%6.7% of republic area. Vegetation is defined as indicator of desertification, in which the domination of turf cereals according to classes of desertification yields to ephemera and ephemeroids. Kalmykia is a cattle-breeding region and therefore the leading biogenic factor is cattle pasture. In the Soviet period the classes of strong and very strong desertification took 47.4% of the region's area, among them wind erosion 10%, weak class only 9.3%. At the end of the 20-th century the territory of Kalmykia corresponded to the zone of ecological disaster.

According to the data of the map «Arid lands desertification of Russian Precaspian area» (2001) at the beginning of the 21-st century within the region's range there dominated weak class on the area of 7.91%, strong and very strong took 8.7%. It is explained by the change of arid climatic cycle into humid, by the change of geopolitic situation in the country.

Precipitation amount increase and abrupt decrease of cattle population from 3.5 million up to 450 thousand resulted in the restoration of vegetation. At present active cattle population growth is taking place, this factor increases pasture loading and activates desertification process. It is expected that Kalmykia will become the zone of ecological tension again during the next 5-8 years.

Large-scale grassland restoration by filling of drainage canals - Effects of the surroundings and environmental variables on alkali grassland recovery

OrsolyaValkó[1], Tamás Miglécz[1], Balázs Deák[2], Gergely Szabó[3], Szilárd Szabó[3], András Kelemen[1], István Kapocsi[2], Szilvia Göri[2], Péter Török[1], Béla Tóthmérész[1]

valkoorsi@gmail.com

1) Department of Ecology, University of Debrecen, H-4010 Debrecen, Hungary
2) Hortobágy National Park Directorate, H-4024, Debrecen, Sumen utca 2, Hungary
3) University of Debrecen, Department of Natural Geography and Geoinformatics, Debrecen, Hungary

Alkali grasslands in East-Hungary are one of the best preserved grassland ecosystems in Europe and are priority habitats of the Natura 2000 network. Alkali grasslands were threatened by fragmentation caused by the establishment of drainage canal systems during the 70's and 80's. These canals were landscape scars and also formed barriers for management by livestock grazing .To mitigate these effects, landscape-scale grassland restoration programmes were started on 4000 hectares to eliminate canals by soil-filling and to restore grasslands and improve landscape connectivity. We studied spontaneous recovery of alkali grasslands in a multi-site study with space for time substitution. We studied grasslands on former canals restored by soil-filling between 2003 and 2011 in 8 "puszta" regions of Hortobágy National Park. We recorded the percentage cover of vascular plants in altogether 558 plots in 2012. Species composition of alkali grasslands is generally influenced by soil salinity and micro-relief; thus, we studied (i) soil parameters (salinity, pH and soil water content) and (ii) cross-section micro-relief profile in soil-filled canals. We found that vegetation of soil-filled canals became similar to the surrounding grasslands within 5-9 years independently of the surrounding grassland types. Grassland recovery on soil-filled canals was fast as (i) they were surrounded by target grasslands and (ii) have a low perimeter/surface ratio, which enables fast immigration of target species from the surroundings. We found that the number and cover of weed species correlated negatively with soil salinity. Thus, grassland recovery was faster in sites with high soil salinity. Micro-relief profile significantly influenced grassland recovery: even soil surface favoured the recovery of vegetation similar to the surrounding grasslands. Rugged soil surface favoured the establishment of noxious weeds (like Cirsium and Carduus species) hampering restoration success. We found that grassland recovery on soil-filled canals depended largely on soil salinity and micro-relief, while surrounding grassland type and time since soil-filling had a subordinate role. To facilitate restoration success precise soil smoothening is essential, even in those sites, which are surrounded by target grasslands. In the studied alkali grasslands, as small as a few centimetres unevenness in soil surface can hamper restoration success.

Ecological and biochemical features of *Cichorium inbytus* in arid conditions of Europe

Danara Vankaeva

danya80389@yandex.ru

Kalmyk State University, Pushkin Str. 11, 358000 Elista, Republic of Kalmykia, Russia

The study of biological resources, their rational use is always significant. Republic of Kalmykia as arid region of Europe is characterized by rich species composition of Aster family. A rather interesting species among them is *Cichorium inbytus*. The aim of our research was the identification of ecological and biological features, biochemical composition of the species in arid conditions of Kalmykia and also the specificity of ascorbic acid and hard metals accumulation. Adaptation of *Cichorium inbytus* to arid conditions is expressed in its anatomic structure, development, ascorbic acid accumulation, resistibility to heavy metals. Methods of research do not differ from those generally adopted. The research showed that carbohydrate compounds are in parenchyma, in the primary and secondary cortex of the root, pith and heart-shaped rays of the stem. The carried out research proves that *Cichorium inbytus* has a long life cycle (240days) in comparison with moderate latitude(120 days) [1].

We have found out that *Cichorium* germination appears at 2-30C. The strong seedlings endure morning frosts up to -4-5°C. But in dry weather it was noted that growth was lagging behind and phenophase was also observed. The crop was watered once a decade, it needed 20 l of water for 5 m² of *Cichorium* crops.

The research was done on the ground and the dried overground and underground parts of *Cichorium* were gathered during flowering and fruiting. The content of ascorbic acid was 50.4 mg/g on experimental plots, but in natural conditions the lowering of index from 31.5 mg/g up to 29.3mg/g was observed. Vitamin “C” accumulation in flowers increases by the end of the month, this can be connected with the protective reaction of generative organs to the temperature stress. Thus, the content of ascorbic acid in the roots of *Cichorium inbytus* depends directly on the natural climatic conditions and, first of all, on the air temperature on the territory of Kalmykia. The study of hard metals composition in Cichorium root showed high content of zinc. Thus, in spite of aridness Kalmykia is optimal climatic zone for *Cichorium inbytus* introduction.

Xerothermic habitats - community dependent context of pollen production

MałgorzataWrzesień

mseptember@tlen.pl

Maria Curie-Sklodowska University, Institute of Biology and Biochemistry, Department of Geobotany, Akademicka str. 19, 20-033 Lublin, Poland

Pollen has dual function in plant communities (i) it is essential for plant sexual reproduction, (ii) it affects genetical structure of population. Most species rely on insects as vectors for pollen transfer although the flower-insect relationship in biocenoses is intricate. Insects may function (i) as effective pollinators that deposit pollen on stigmas, (ii) or as flower visitors that remove pollen from anthers. In this context pollen is important for insects as food (a source of proteins, fat, starch, vitamins, hormons) and influence their vigor as pollinators.
Currently, habitat destruction and fragmentation are broadly deleterious to insect pollinators. In Europe declining of different Apoidea is documented in many countries. Also xerothermic vegetation declined dramatically and many species of xerothermic habitats face an increased risk of extinction. In Central Europe thermophilous phytocoenoses are represented by Festuco-Brometea and Rhamno-Prunetea classes. As there is a simple correlation between plants diversity and pollinators diversity both insect and plant species need special policy in fragmented habitats.
Patches of xerothermic habitats are valuable as pollen food resources due to 1) the seasonal continuity of forage from early spring until late summer, 2) the amount of pollen production, 3) the plant species richness that ensure diversity of diet for pollinators.

Dry grasslands in the planned econet of steppe zone of Ukraine and their protection”

Dmytro Dubyna, Tetiana Dziuba, Svitlana Iemelianova

ms.deputat@mail.ru

M.G. Kholodny Institute of Botany, National Academy of Science of Ukraine, Tereshchenkivska str. 2, 01601 Kyiv, Ukraine

Ukraine is the only state in the post USSR, which has a normative base for the creation of an ecological network. It has worked out several of its variants for the steppe zone. The econet created by M.G. Kholodny Institute of Botany NAS of Ukraine staff is one of exhaustive among them. The basic principles of elements selection (key and connecting territories) are the maximum representation of biological and landscape diversity. The econet of Ukrainian steppe zone includes 3 international, 24 national and 38 regional key territories and 4 international, 4 national and 21 regional ecocorridors. Dry grasslands of key territories represented by 147 associations belonged to 28 alliances, 10 orders and 5 classes (Festuco-Puccinellietea, Festuco-Brometea, Festuceteavaginatae, Koelerio-Corynephoretea, Glycyrrhizetea glabrae). The highest syntaxonomical richness is marked in Festuco-Brometea (73 associations, 14 alliances, 2 orders) and Festuco-Puccinellietea (37 associations, 8 alliances, 4 orders) classes. The average index of syntaxonomical diversity is determinate in Festucetea vaginatae (31 association, 3 alliances, 1 order). The lower levels of coenotical diversity are observed in Koelerio-Corynephoretea (4 associations, 2 alliances, 2 orders) and Glycyrrhizetea glabrae (2 associations, 1 alliance, 1 order) classes. The communities of Festuco-Puccinellietea and Festuceteavaginatae classes are most represented and occupy the largest areas. They are typical for the coastal part of steppe zone (Azovo-Chornomorskyi ecocorridor). Other classes occupy smaller areas and are confined to the upland plots of Starobilsko-Budzhakskyi ecocorridor. It caused excessive transformation of the formerly presented territories. The econet formation on normative level establishes the preservation of all biodiversity. It is very important for dry grasslands too. The next and equally important step is to develop management plans for this type of vegetation. It will be based on preservation and enrichment of existing coenotical diversity, protection of rare and defenseless ones. The restoration of disturbed areas in connection with the modern ecological situation in the region is very important for conduction of preventive measures for minimizing the newest anthropogenic influences, reduction of energy costs of managing and its subordination environmental strategy.

Classification of mesic grasslands in the northern Carpathians – preliminary results

Milan Zajac[1], Zygmunt Kącki[2],Joanna Korzeniak[3], Wolfgang Wilner[4], Monika Janišová[5]

milan.zajac1986@gmail.com

1) Slovak Academy of Science, Institute of Botany, Dubravskacesta 9, 845 23 Bratislava 4, Slovakia
2) University of Wroclaw, Department of Biodiversity and Plant Cover Protection Institute of Plant Biology, ul. Kanonia 6/8, 50-328 Wrocław, Poland
3) Instytut Ochrony Przyrody PAN, al. A. Mickiewicza 33, 31-120 Kraków, Poland
4) Vienna Institute for Nature Conservation & Analyses, Giessergasse 6/7, 1090 Vienna, Austria
5) Institute of Botany, Slovak Academy of Sciences, Dúbravskácesta9, 845 23 Bratislava, Slovakia

Questions: i) What is the variation in species composition of mesic grasslands in northern Carpathians including the Western Carpathians and the northern part of the Eastern Carpathians? ii) Which main syntaxa can be distinguished at the level of alliances and associations? iii) How do the classification results correspond to the national classification systems of the involved countries?
Location: Carpathian part of Austria, Czech Republic, Hungary, Poland, Slovakia and Ukraine.
Methods and results: Large phytosociological data set was prepared (11 280 relevés) by selection of phytosociological relevés of mesic grasslands (meadows and pastures) ordered to one of the following alliances by the original authors: Arrhenatherion elatioris, Cynosurion cristati or Polygono bistortae-Trisetion flavescentis within the class Molinio-Arrhenatheretalia and Violion caninae or Nardetum strictae-Agrostion tenuis within the class Nardeteastrictae. Only relevés recorded on plots sized from 4 to 100 m2 were included. Different methods of ordination, numerical and formalised classification were adopted to prepare a preliminary classification system valid for the whole studied area. The resulting classification was compared to classification systems used in each of the involved countries. Most striking divergences between the national and supra-national approaches were pointed out and several modifications in classification system were suggested in order to unify the classification of Carpathian mesic grasslands. Simultaneously, the poorly investigated regions were selected within the study area where future phytosociological field research should be focused.
Financial support: was provided by VEGA 2/0099/13.

Evaluation of temporal changes of NDVI as an indicator of grasslands restoration agri-environmental programs: A case study of Tzoumerka mountain, Greece

Christos Roukos[1], Sotirios Kandrelis[2], Charalambos Koutsoukis[2], Evripidis Glavas[2]

roukxris@gmail.com

1) OPEKEPE-Greek Payment Authority of CAP Aid Schemes, Greece
2) Technological Educational Institute (T.E.I.) of Epirus, Faculty of Agriculture, Department of Animal Production, 471 00 Arta, Greece

The assessment of agri-environmental programs is required in order to ascertain the environmental and socioeconomic impacts; analysis of these may contribute to the rational design of future agri-environmental measures.
Time series of satellite data provide unparalleled information on the response of vegetation to grazing variability. Detecting subtle changes in vegetation over time requires consistent satellite-based measurements.
A seven-year (2006 – 2012) history of moderate resolution imaging spectroradiometer (MODIS) normalized difference vegetation index (NDVI) data derived from Landsat satellite was analyzed for livestock extensification agri-environmental program evaluation within the north-west Greece, specifically for the Tzoumerka Mountain.
Two adjacent grassland areas (Theodoriana and Athamanio) with similar characteristics (e.g. slopes, stocking density) of Tzoumerka Mountain are selected. In Athamanio grassland area, the livestock extensification agri-environmental program has been applied since 2007. Since then, stocking density significantly decreased. In the adjacent grassland area of Theodoriana, none agri-environmental program has been applied up till now.
Analysis revealed that NDVI had a strong negative correlation with stocking density, slope and temperature and a positive one with rainfall. The livestock extensification agri-environmnetal program implementation had a positive impact on NDVI but not as strong as it would be expected. Also, agri-environmental program weakness points are discussed and possible feasible solutions are given taking into account the structure of Greek Integrated Administration and Control System (OSDE).
Conclusively, initial results show that NDVI can be a useful indicator for grasslands agri-environmental programs evaluation.