

# 18th Eurasian Grassland Conference

Szarvas, Hungary, 25-28 September 2023

Book of abstracts



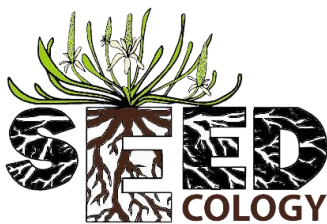
Edited by Katalin Lukács



# 18th Eurasian Grassland Conference

Conservation and management of grasslands in transforming landscapes  
Szarvas, Hungary, 25-28 September 2023

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**Abstracts**  
**Keynote lectures**

## **New challenges of nature conservation in the light of landscape-level changes in the Great Hungarian Plain**

**András Kelemen**

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In the Great Hungarian Plain, near-natural habitats can still be found in large areas even today, they are mainly grasslands developed on poor soils that have limited suitability for intensive agriculture. Nowadays, the most important threats to these grasslands include climate change, the spread of invasive species, and unfavourable water management, forest management, and game management practices. The effects of climate change lead to a pronounced decrease in the amount of precipitation during the vegetation season, lengthening of drought periods, and milder winters. To preserve wetland habitats, landscape-level interventions are necessary, as well as the integration of secondary wetlands into conservation strategies. The landscape-level drying affects negatively not only moist habitats but also dry grasslands. Climate change requires a rethinking of conservation management practices, such as support year-round grazing or winter grazing, and finding opportunities to solve management practices traditionally done on frozen soil or ice. Habitat reconstruction using seed sowing and hay spreading is also much more difficult nowadays, as seed production and the establishment of sown plants are much more unpredictable than before. In some cases, the afforestation efforts and overpopulated games can amplify the effects of climate change. The spread of invasive plant species is also becoming an escalating problem, especially with the spread of C4 grasses presenting a significant challenge. In this keynote lecture, I will provide a short overview of the vegetation of the Great Plain, with special emphasis on the Danube-Tisza Interfluve. Furthermore, I will discuss the causes and effects of landscape-level changes, as well as, the potential solutions to the problems that have been raised. Unfortunately, it is not possible to provide solutions to every problem, but we are making progress.

## **Data collected by amateur botanists: coupling an old tradition and citizen science offers new opportunities for habitat monitoring and conservation**

**Corrado Marcenò**

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The coupling of amateur botanists' age-old tradition with citizen science and the use of digital photographs presents exciting opportunities for habitat monitoring and conservation. Driven by their passion for plants, amateur botanists contribute valuable data on plant species and habitats, leveraging digital photographs as scientific records. This practice provides insights into ecosystem dynamics and supports conservation initiatives. The utilization of digital photographs offers benefits such as increased data collection, enhanced spatial and temporal coverage, rapid response to conservation needs, and cost-effective monitoring. However, challenges related to data quality, accuracy, and standardization must be addressed to fully exploit the potential of amateur botanist-collected data. Despite these challenges, collaborative efforts between amateur botanists and professional scientists, enabled by digital photographs, have immense potential for advancing botany, understanding ecosystems, and supporting conservation. By overcoming challenges and implementing suitable protocols, this collaboration can contribute to a comprehensive understanding of plant biodiversity, fostering the protection and sustainable management of natural environments.

## New insights on the broad-scale classification of European dry grasslands and scrub vegetation

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The dry grassland and scrub vegetation of Europe exhibit quite complex and sometimes unclear syntaxonomy. Often, even higher-level syntaxonomical units are treated differently by different authors. One of the most widespread classes in Europe is the *Festuco-Brometea* class, which comprises zonal xeric, xero-mesic, and rocky grasslands on various substrata. This class borders with other climatically different classes of dry grassland and scrub vegetation, such as *Lygeo-Stipetea*, *Ononido-Rosmarinetea*, *Festuco hystricis-Ononidetea striatae*, *Elyno-Seslerietea*, *Daphno-Festucetea*, etc. We conducted a study of vegetation plots from different parts of Europe regarding their syntaxonomical assignments. Based on the results, we propose several changes in the high-rank syntaxonomical units of European dry grassland and scrub vegetation. At the class level, we suggest splitting the class *Festuco hystricis-Ononidetea striatae* into three parts and merging them with other classes: *Festuco-Brometea* (*Ononidetalia striatae* and *Erysimo-Jurineetalia* orders), *Elyno-Seslerietea* (*Festucion burnatii* and *Festucion scopariae* alliances), and *Ononido-Rosmarinetea* (*Festuco hystricis-Poetalia ligulatae* p.p.). Our analysis supported restoring the class *Cisto-Micromerietea* from the *Ononido-Rosmarinetea* due to significant floristic differences and evolutionary history. The results have shown that in the Transcaucasian region, temperate dry grasslands of *Festuco-Brometea* still remain at higher elevations, while xeric Western Asian dry grasslands and thorn cushion communities replace them at lower elevations. We propose classifying these areas within a new (provisional) class called *Ziziphoro tenuioris-Stipetea arabicae*. At the level of syntaxonomical orders, we suggest creating several new units that combine climatically and floristically different types of dry grasslands belonging to the *Festuco-Brometea* vegetation class. These include *Galatello villosae-Stipetalia lessingiana* for the steppe vegetation of the steppe zone of Europe, *Cephalario uralensis-Jurineetalia stoechadifolii* for the vegetation of calcareous outcrops in the steppe zone as a vicariant of *Stipo pulcherrimae-Festucetalia pallentis*, *Asphodelino tauricae-Euphorbietalia petrophilae* uniting North Caucasian and Crimean xerophilous rocky grasslands on calcareous outcrops, and *Plantagini atratae-Bromopsietalia tomentellae* for high-mountain subalpine communities of Caucasus. Additionally, there are several proposed changes in the subordination of orders and alliances.

## **Grassland restoration and management: a focus on animals**

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Animals have long been known to play fundamental roles in ecosystem functions and services, yet there is still little focus on animals in whole-ecosystem restoration. This talk aims to go beyond this situation by discussing ways to favour animals in grassland restoration. I first argue that the grasslands we now see and try to protect or restore are often incomplete as ecosystems because they are often small fragments characterised by lopsided trophic structure, few keystone or ecosystem engineer animals, and missing ecosystem functions. One way to bring back animals is rewilding, i.e., the reintroduction of top predators (mostly done in North America) or large herbivores (mostly in Europe). While rewilding is promising in many ways, it is not commonly available as a restoration option, and we should thus explore other ways to focus restoration on animals. Next I will briefly summarise current knowledge on how grassland restoration affects major animal groups. Invertebrate animals typically quickly follow the changes in vegetation composition and structure. Herbivorous and vegetation-dwelling species, which largely respond to vegetation composition, generally increase in abundance or diversity with time. In contrast, predatory and soil surface-dwelling invertebrates, which largely respond to vegetation structure, initially increase as generalist species appear, then decrease as generalist species gradually disappear from restored grasslands while specialist species colonise the restored grasslands. The few studies of vertebrate animals generally find slower and/or unequivocal responses and/or landscape-scale effects of restoration. One important message from these studies is that we can maximise animal diversity by creating different habitats, i.e., by increasing habitat diversity through the restoration of variability rather than of a limited number of specific target states. I show that increasing habitat diversity is a well-established paradigm in aquatic ecosystem restoration, and I argue that terrestrial restoration could learn from this experience. I see four ways of increasing habitat diversity in restoration: (i) varying the starting conditions, (ii) establishing keystone structures, (iii) emulating natural disturbances, and (iv) applying ecosystem engineers. However, an increasing number of studies also show that post-restoration management may be even more important to animals than restoration itself. I will briefly discuss why the Field of Dreams hypothesis („if you build it, they will come”) may not work in grassland restoration. More specifically, I will discuss the issue of arthropod decline in grasslands, the widespread use of veterinary drugs for the treatment of grazing livestock as one potential cause for this decline, and possible ways around this problem. I will then argue for insect-friendly grazing and demonstrate ways to achieve it in grazed grasslands. Grasslands need their animals to develop into healthy functioning ecosystems teeming with life. We should carefully evaluate whether we can guide degraded ecosystems toward a better ecological and conservation status by restoration only, by management only, or by both combined.



# **Abstracts**

## **Oral and poster presentations**

## Oral presentation

**The night shift: bioacoustics at night disclose ecological relationships in Mediterranean dry grasslands****Leonardo Ancillotto<sup>1,2</sup> & Rocco Labadessa<sup>3</sup>**

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Mediterranean dry grasslands are home to a wide diversity of wildlife, yet most current knowledge is mainly focused on diurnal and charismatic taxa. A rich literature is in fact available on how plant diversity and vegetation structure in such environments shape the occurrence and assemblage composition of e.g., birds and butterflies, while little is known about the nocturnal inhabitants of the grasslands and their ecological interactions. In this context, bioacoustics may allow to simultaneously sampling a wide range of sound-emitting taxa and foster an in-depth knowledge of trophic chains in grassland ecosystems, particularly in the case of secretive taxa such as nocturnal species. Here we aimed at testing the potential of bioacoustics in assessing ecological interactions of secretive taxa in grassland ecosystems, specifically focusing on bats and their insect prey. We applied an interdisciplinary approach by combining vegetation assessments and bioacoustics to test for ecological relationships among nocturnal taxa in Mediterranean grasslands. More specifically, we paired vegetation relevées and autonomous bioacoustic sampling, setting our study at grasslands sites within the Alta Murgia National Park (S Italy). We particularly focused on quantifying patterns of occurrence and activity levels of a specialised grassland predator – the Lesser mouse-eared bat *Myotis blythii* – and its main prey – bush-crickets (Orthoptera), assessing the relative roles of landscape metrics and vegetation structure in driving their co-occurrence patterns both directly and indirectly. Specifically, we measured the amounts of different land cover classes, including cropland and High-Diversity-Grasslands and the diversity of the herbaceous canopy. Prey availability was measured as both richness and activity levels of prey, as assessed by the acoustic analysis of the recorded files. We successfully detected the occurrence of both the target species *M. blythii* and of at least 16 species of Orthoptera potential prey within the recorded files. The activity levels of the Lesser mouse-eared bat were directly driven by landscape composition in the surroundings of the recording sites, showing a negative effect of the amounts of cropland. The latter, also had a cumulative indirect - negative - effect on bats, by affecting prey richness, which conversely was fostered by higher amounts of High-Diversity-Grasslands. Moreover, *M. blythii* also increased its activity levels at sites with higher apparent prey abundances, which in turn was significantly and positively influenced by higher values of complexity of the herbaceous layers. Our results confirm the importance of protected high diversity grasslands in sustaining complex trophic chains in open environments, fostering richer Orthoptera assemblages that, in turn, favour a top predator like the bat we focused on. Besides, our work also highlights the great potential of bioacoustics as a tool for multi-taxa approaches in ecological studies on grasslands.

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**Oral presentation****♣ Grassland management experiences of Hortobágy National Park Directorate in the context of LIFE IP GRASSLAND-HU project****Szabolcs Balogh<sup>1</sup>, Ambrus Barabás<sup>1</sup>, Béla Habarics<sup>1</sup>, Péter Barna<sup>1</sup> & Attila Filep<sup>1</sup>**

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Within the framework of the LIFE IP GRASSLAND-HU "*Long-term preservation of Pannonian grasslands and related habitats by implementing the strategic measures of the National Natura 2000 Priority Action Plan*" LIFE17 IPE/HU/000018 project, several habitat rehabilitation works are managed in the area of the Hortobágy National Park Directorate. Within the Nyírség-Szatmár-Bereg Landscape, four project sites have been designated with different habitat characteristics (with a total area of 169 hectares), three of them are in the Szatmár-Bereg site (Kaszonyi Hill in Barabás, bog meadow in Fülesd, pasture in Hetefejércse), and one in the Nyírség area (Daru meadow in Petneháza). Due to unfavourable changes in landscape use over the last decades, habitats have been degraded and the floristic and faunal values became endangered. Therefore, nature conservation treatments (managed on 111.5 hectares) are mainly focused on the elimination of invasive species, reconstruction of grassland and water management, as well as the implementation of grazing livestock with the aim of implementing gentle treatment for protected plants. The efforts are well confirmed by the successful rehabilitation of several grassland patches to increase the reappearance of protected plant and animal species. Moreover, the reconstruction of grassland in Daru-rét with a seed mixture of 129 species is a unique planting experiment in Europe.

## Oral presentation

### ♣ Traditional ecological and herding knowledge in the forest steppe region in Mongolia

**Gantuva Batdelger<sup>1,2</sup>, Beáta Oborny<sup>1</sup> & Zsolt Molnár<sup>3</sup>**

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Traditional knowledge and practices of plants, habitats and livestock herding are increasingly acknowledged as vital for the sustainable use of natural resources and efficient nature conservation. However, some scientists argue that traditional knowledge may become inadequate, because locals are unable to adapt to the rapid socio-ecological changes. We hope that a deeper understanding of how herders perceive ecological changes and traditional herding knowledge would be useful for improving pasture management and promoting regeneration processes. Our objectives were to reconstruct the folk habitats locals use to partition landscapes, to reveal how herders perceive ongoing ecological changes, and to test whether the knowledge about the ‘proper’ ways of grazing, the adequacy of the applied traditional practices, or the ways herders actually manage herds and pastures changed most. Our study areas were located in the mountain forest-steppe region in Mongolia. In 2017-2023, we interviewed 56 people using photos of plant species and habitats and semi-structured interviews focusing on landscape change and folk plant classification. We also studied the present-day understanding, reported validity and relevance of best herding practices documented 80 years ago by Sambuu (1944) together with the socio-ecological drivers of experienced changes. Mongolian herders distinguished 88 folk habitat types, habitat classification was multidimensional; key dimensions were geomorphological and edaphic. There were some species (e.g., *botyuul*, *hyag*, *shireg*) and species groups (hot plants and leafy plants) that were often used to describe habitat types. We found 32 indicators on how herders perceived landscape and vegetation changes for the 14 main habitat types studied. Our finding on traditional herding practices shows that almost all herding advices documented 80 years ago were agreed with by Mongolian herders as still valid today, however, only half (34) of the advices were still followed by them. The ways herders actually herded livestock changed considerably, former practices were often replaced with less proper and less sustainable one (according to herders). We conclude that conducting research on folk habitats will contribute to a deeper understanding of how nature is perceived by locals and to a more efficient management of the Mongolian pastures. As well as adaptive capacity of herders’ knowledge and practices seemed challenged by the current social-ecological changes. Traditional knowledge is still valid from a biological and ecological point of view but is decreasingly relevant for everyday life. Advices abandoned most often were those that require bigger time investments from herders and are less compatible with modern lifestyles or need cooperation among herders. However, knowledge loss among the younger generation may be an accelerating driver, affecting the adaptive ability of the herding community. We suggest to promote the adapted best practices of our times and remind people that herding does not simply mean to let livestock graze and to follow them in the direction they go, but “herders’ duty is to think” – as herders say, and to herd livestock properly to achieve good fattening and successful reproduction.

## Oral presentation

**♣ Impact of four years of mechanical treatment of the invasive plant *Asclepias syriaca* L. on other plants species in secondary grasslands****Boglárka Berki<sup>1,2</sup>, Edina Csákvári<sup>2</sup>, Adrienn Gyalus<sup>1,2</sup>, András Mártonffy<sup>3</sup>, Melinda Halassy<sup>2</sup>, Tamás Rédei<sup>2</sup>, Zoltán Botta-Dukát<sup>2</sup> & Anikó Csecserits<sup>2</sup>**<sup>1</sup>Doctoral School of Biology, Institute of Biology, Eötvös Loránd University, Hungary, 1117 Budapest, Pázmány Péter sétány 1/C<sup>2</sup>National Laboratory for Health Security, Institute of Ecology and Botany, Centre for Ecological Research, Alkotmány út 2-4, 2163 Vácátót, Hungary<sup>3</sup>Institute of Biology, Eötvös Loránd University, Hungary, 1117 Budapest, Pázmány Péter sétány 1/C  
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Invasive alien plants can affect the vegetation composition of different habitats, and outcompete native plants; causing homogenization of vegetation. In our study, we examined the impact of the invasion of *Asclepias syriaca*, a non-native herbaceous species, on basic soil attributes and vegetation composition, and studied the effect of cutting treatment of *Asclepias* shoots and on other plant species. Our study areas were in the sandy region of Kiskunság National Park, near the village of Fülöpháza. We assigned ten old-fields, on each four 4 m x 4 m plots were established, of which three were invaded by *Asclepias*, and one plot was uninvaded. The invaded plots treatment were: (1) all *Asclepias* shoots were removed, (2) half number of the *Asclepias* shoots removed, and (3) untreated. The treatment was conducted twice a year during summer in the 2019-2022 periods. Before the first treatment, soil and vegetation were sampled. Afterwards, vegetation monitoring was performed twice a year: the cover of each vascular plant species and the number of *Asclepias* shoots were recorded in each plot. Our results showed that there were no differences in the studied soil attributes between the uninvaded and invaded plots. However, we found that the cover of sand grassland specialist plants was higher in uninvaded plots. Short-term cutting treatment negatively affected *Asclepias* shoots, after the second-year treatment. The cover of specialists did not change in response to treatments, but the cover of other neophyte plant species increased. Our results show there is different vegetation composition at *Asclepias* invaded plots, but there is no difference in soil attributes. We conclude that more time or additional treatment is required for native plants' recovery.

## Oral presentation

**Oral history reveals driver interactions behind land-use legacies in a transforming cultural landscape****Marianna Biró<sup>1</sup>, Dániel Babai<sup>2</sup>, Kinga Öllerer<sup>1,3</sup>, Réka Szilágyi<sup>4</sup>, Krisztina Molnár<sup>5</sup>, Csaba Molnár<sup>6</sup> & Zsolt Molnár<sup>1</sup>**<sup>1</sup>Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary<sup>2</sup>Research Centre for the Humanities, Institute of Ethnology, Budapest, Hungary<sup>3</sup>Institute of Biology Bucharest, Romanian Academy, Bucharest, Romania<sup>4</sup>Doctoral School of Biology, Institute of Biology, Eötvös Loránd University, Budapest, Hungary<sup>5</sup>Budapest<sup>6</sup>Gömörszőlős[biro.marianna@ecolres.hu](mailto:biro.marianna@ecolres.hu)

Present vegetation patterns and dynamics are driven by multiple direct and indirect drivers at various spatial and temporal scales. Grasslands in a cultural landscape are usually the reflections of the past, and their characteristics are often the legacies of former land-use practices. We studied HNV grasslands in a transforming cultural landscape in Transylvania, Romania (Kalotaszeg region). We conducted semi-structured oral history interviews, related to three time periods of the last 70 years (before, under and after the collectivised agriculture). We focused on small vegetation units (0.1-20 ha) from two villages in order to explicitly identify the often hidden land-use legacies and interactions of ecologically relevant indirect and direct drivers behind them. We identified 40 vegetation characteristics as historical legacies of former land-use activities. Legacy types included former cultivation, use as forest pasture or temporal intensity change in the grassland management (increase, decrease, intensification). Legacies of former management practices, as tending wild trees and bushes, continuous traditional grassland management in the past, care and protection of ecosystem services were also detected in the grasslands. Among the ecologically relevant drivers behind the land-use legacies we identified interacting socio-economic drivers on different scales. Driver interactions were mainly initiated by national-scale external drivers starting in the 1950s and resulting in delayed local-scale consequences, as labour outflow to cities and ageing of the local population, detectable by the 2000s. Interviewees emphasized that these demographic drivers could be considered as the main causes of many current vegetation characteristics, and the abandonment of the traditional hay meadow management on species-rich grasslands. They argued that today only the EU agricultural subsidies and large-scale extensive sheep pasturing sustain the grasslands, as interviewees said '*it would be bushy without the sheep*'. We found that socio-economic drivers during the last 70 years led to a decreasing number of people managing natural resources, and to a homogenizing landscape with a simplified land-use, which is increasingly dependent on external financial resources. Many vegetation characteristics of the present species-rich grasslands are only the historical legacies of former land-use and land-management practices, and the decrease of their biodiversity is inevitable without targeted interventions. Semi-natural hay meadows of outstanding species richness are especially threatened by abandonment and transformation into sheep pastures and require particular conservation attention.

## Poster presentation

**♣ The impact of low-intensity, regular-intensity mowing and mowing abandonment on a diversity of semi-natural grasslands in South Moravia (Czech Republic)****Dariia Borovyk<sup>1,2</sup>, Helena Chytrá<sup>1</sup>, Daniel Kadaš<sup>3</sup> & Kryštof Chytrý<sup>1,4</sup>**<sup>1</sup>Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic<sup>2</sup>M.G. Kholodny Institute of Botany, NASU, Kyiv, Ukraine, Czech Republic<sup>3</sup>Správa CHKO Pálava, Mikulov<sup>4</sup>Department of Botany and Biodiversity Research, University of Vienna, Vienna, Austria[dariaborovyk@gmail.com](mailto:dariaborovyk@gmail.com)

Central European grasslands have been shaped by traditional agricultural societies for centuries. They were subjected to long-term traditional management practices that have established a fragile equilibrium, resulting in high species richness, diversity of nowadays rare and endangered species, and numerous ecosystem services. Socioeconomic changes in Central Europe since the 1950s have led to a large-scale abandonment of traditional management practices in grasslands. In order to prevent biodiversity losses, they are nowadays often substituted by nature conservation. However, conservation authorities usually operate on restricted habitat islands of nature reserves where it is substantially challenging to find the balance that maintains the high biodiversity of these grasslands. A popular approach to support all facets of grassland biodiversity is mosaic mowing. Our study aims to assess the effects of long-term mosaic mowing, low-intensity mowing and regular mowing on plant diversity in semi-dry grasslands of South Moravia. In May-June 2023, we sampled 93 grassland plots within 48 protected areas of the study area. These plots were selected to represent different management conditions, such as managed areas representing different mowing types and abandoned areas. Preliminary results indicate that abandoned sites showed a significant accumulation of dry biomass (litter), encroachment of woody species (juveniles and shrubs), and a reduction in the participation of specialist species of the target grassland habitats. Long-term abandonment also resulted in a decrease in overall species richness, particularly affecting rare and protected species. Simultaneously, generalist species, expansive species, and species of mesic habitats were becoming more widespread. The most common expansive species of shrubs were *Cornus sanguinea*, *Crataegus monogina*, *Prunus spinosa*, *Rosa spp.*, while among grasses - *Arrhenatherum elatius*, *Calamagrostis epigejos*. Sites with irregular or low-intensity mosaic mowing also resembled, albeit to a lesser extent, the pattern of abandonment, such as increased litter accumulation and woody and expansive species encroachment. After completion of the project, we intend to provide management recommendations to prevent changes in the grassland communities and effectively maintain their diversity.



## Poster presentation

**Vegetation dynamics on riverine sand dunes in the Dnieper river basin****Liubov Borsukevych<sup>1</sup>**<sup>1</sup>Botanical Garden of Ivan Franco National University, Lviv, Ukraine  
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Inland sand dunes on fluvioglacial deposit have a considerable distribution in the forest and forest-steppe zones of Ukraine. They occupy great areas in the Dnieper basin, especially in the Left-Bank, which is caused by intensive erosion and accumulative processes in historical times. Our research based on 109 vegetation plots sampling across floodplains of the big rivers in the period of 2017-2020 and local literature data. The main ecological parameters (altitude, aspect, inclination, microrelief, plant cover structure) are recorded for each plot. The aim of our study was to investigate the influence of ecological and geomorphological factors on the distribution patterns and diversity drivers of the vegetation in floodplains of the Dnieper river basin. Within studied vegetation we recorded 320 plant species in generally. There are on the average 12-28 (max. 54) species of vascular plants and 2-4 species of bryophytes and lichens per plot. A significant part of their floristic core is both diagnostic species of shrub vegetation and grasslands. In general, the most common plants are *Agrostis vinealis*, *Calamagrostis epigeios*, *Carex colchica*, *C. praecox*, *Poa angustifolia*. The main studied communities belong to the *Salicetea purpurea* (*Artemisio dniproicae-Salicion acutifoliae* all.) and *Molinio-Arrhenatheretea* class (*Agrostion vinealis* all.). They occupy great areas on high-elevated alluvial, rarely flooded, river terraces mostly in the forest-steppe zone of Ukraine. Water regime changes intermittently from wet to semi-dry and dry conditions, and depends mostly on precipitation. These communities are distributed in continental region of Eastern Europe and probably have no analogues in the vegetation of western Europe. Its basic features are: subxeric character, highly variable moisture regime including occasional spring flooding and summer dry, continental climate. Their development seems to be conditioned by hydrological and geomorphological peculiarities of the floodplains of the Dnieper River and its tributaries as well as the regional climate. The communities of the *Artemisio dniproicae-Salicion acutifoliae* all. develop after new alluvial sand dunes forming. This vegetation presents xerophytic character (more than 60% of species are xero- and xeromesophytes, but they need some wet conditions for germination). On fine sandy substrate with noticeable fraction of turf psammophytic dry grasslands of *Agrostion vinealis* all. develop. There are two dynamic trends depending dunes height and structure. The driest highest sandy hills of the central part of the floodplain are usually covered by pine forests of *Pulsatillo-Pinetetea* class (*Koelerio glaucae-Pinetalia sylvestris* all.) and continental fescue sandy steppes of *Koelerio-Corynephoretea canescentis* (former *Festucetea vaginatae*) class (*Festucion beckeri* all.). They rise up to 10–12 m above the floodplain with a peak altitude of about 120 m a.s.l. With humus concentrating and moisture increasing on the plain parts the mesophytic hay meadows of *Molinio-Arrhenatheretea* class (*Alopecurion pratensis* all.) and deciduous forests of *Carpino-Fagetea sylvaticae* class (*Quercu roboris-Tilion cordatae* all.) are formed. The main threat to the existence of this xerothermic vegetation is the expansion of shrubs typical for the *Rhamno-Prunetea* class and *Amorpha fruticosa* expansion.



## Poster presentation

**♣ Hitchhiking seeds – The role of off-road vehicles in seed dispersal in protected areas****Sándor Borza<sup>1,2,3</sup> Laura Godó<sup>1</sup>, Orsolya Valkó<sup>1</sup>, Balázs Deák<sup>1</sup>**<sup>1</sup>'Lendület' Seed Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research<sup>2</sup>Juhász-Nagy Pál Doctoral School, University of Debrecen, Debrecen, Hungary<sup>3</sup>Hortobágy National Park Directorate, Debrecen, Hungary[borzas89@gmail.com](mailto:borzas89@gmail.com)

Human-mediated seed dispersal, particularly through transportation, plays a significant role in the dispersal of plant species in terms of both quality (number of species) and quantity (number of dispersed propagules). Off-road vehicles cover significant distances within a given landscape, often interacting with various types of habitats both inside and outside of protected areas and potentially endanger them. Off-road vehicles transport seeds attached to the exterior of the vehicle, which can later fall off, as well as through soil and plant materials that adhere to passengers' clothing and footwear and fall off inside the vehicle. As the number of off-road vehicles is on the rise, it is timely to investigate their impact, specifically targeting the qualitative and quantitative components of this process. The aim of our research was to reveal that how many plant species can be dispersed on the inside and outside parts of off-road vehicles and that what characteristics do these species possess. Our study area was in the Great Hungarian Plain (Hortobágy, Nagyunság). We selected six off-road vehicles that were frequently used in protected areas. We collected samples from inside and outside of the vehicles for one year, in every two months. We conducted a germination experiment of the samples in a greenhouse. So far, more than 4000 specimens of 90 species germinated from the samples. We found considerably more seedlings and species in the samples which were collected from the exterior of the vehicles. Most of the dispersed species were characteristic of disturbed habitats, but the dispersal of specialist species also occurred. We had not identified any potentially harmful adventive or invasive species from the samples so far.

## Oral presentation

**Dry grasslands in the alkaline fens near the city of Chełm (Lublin province, SE Poland)****Anna Cwener<sup>1</sup> & Piotr Chmielewski<sup>2</sup>**<sup>1</sup>Botanical Garden of Maria Curie-Skłodowska University in Lublin, Sławinkowska 3, 20-810 Lublin, Poland,<sup>2</sup>Zamość Wildlife Association, Oboźna 19/8, 22-400 Zamość,[acwener@wp.pl](mailto:acwener@wp.pl)[pchmielewski4@wp.pl](mailto:pchmielewski4@wp.pl)

Pagóry Chełmskie hills is a geographical region located in SE Poland. It is a part of the Polesie Wołyńskie woodland in the East European Plain. Its specificity results mainly from the topographical relief and geological structure. It is composed of scattered hills of variable height and size, built of late cretaceous marls and chalk. Top parts of the hills and the slopes are usually devoid of soil cover and the depressions between the hills are filled with peat soils, sometimes a few meter deep. The presence of limestone bedrock is favorable for calcareous and thermophilous flora. Since the 19th century, rare xerothermic plant species have been reported from these parts, i.e.: *Carlina onopordifolia*, *Echium russicum* and *Veratrum nigrum*. Xerothermic plants can be found in grasslands, fallows, roadsides, even among the wetlands, where they occupy small "islands" called "grądziki", elevated above the water level. In such places the plant communities change as the terrain rises - from reed beds of *Cladietum marisci*, through calcareous fens of *Caricetum davallianae* and meadows of *Molinietum medioeuropaeum* to *Brachypodium pinnatum*-dominated grasslands and the *Inuletum ensifoliae* community at the summit. This local variety of *Inuletum ensifoliae* is devoid of *Carex humilis* and is characterised by the presence of species typical for thermophilous oak woods and bunchgrass meadows, like *Serratula tinctoria*, *Succisa pratensis* or *Carex tomentosa*. According to statistical analyses (Juice 7.0), the diagnostic species for this *Inuletum ensifoliae* variety are: *Inula ensifolia*, *Inula salicina*, *Carex tomentosa*, *Festuca ovina*, *Succisa pratensis*. Constant species include: *Brachypodium pinnatum*, *Galium verum*, *Serratula tinctoria*, *Ononis spinosa*, *Leucanthemum ircutianum*, *Centaurea pannonica*, *Briza media*, *Inula ensifolia*, *Potentilla erecta*, *Molinia coerulea*, *Carex flacca* and dominant species are: *Brachypodium pinnatum*, *Inula ensifolia*, *Molinia coerulea*, *Ononis spinosa*, *Carex flacca*, *Serratula tinctoria*, *Galium verum*. The dry grassland communities on the "grądziki" hills are sanctuaries for rare and protected plant species, like *Cirsium pannonicum*, *Anemone sylvestris*, *Adonis vernalis*, *Orobanche alba* or *Senecio umbrosus*.

## Poster presentation

**The small-scale geographic diversity of dry grasslands of the Lubelskie region (Lublin province, SE Poland)****Anna Cwener<sup>1</sup> & Piotr Chmielewski<sup>2</sup>**<sup>1</sup>Botanical Garden of Maria Curie-Skłodowska University in Lublin, Sławinkowska 3, 20-810 Lublin, Poland<sup>2</sup>Zamość Wildlife Association, Oboźna 19/8, 22-400 Zamość[acwener@wp.pl](mailto:acwener@wp.pl)[pchmielewski4@wp.pl](mailto:pchmielewski4@wp.pl)

Lubelskie (Lublin province) is an area located in south-eastern Poland, between 2 major rivers: Vistula and Bug. It is characterised by great diversity of habitats. The northern part of the region is located in the North European Plain, the central part is located in the zone of southern uplands of Poland and the southern part is situated in the pre-mountain depression. The upland zone in the Lublin region consists of the Lublin-Lviv Upland and parts of the Volhynian-Podolian Upland and Volhynian Woodland. Additionally, Lubelskie is intersected by the Teisseyre-Tornquist Zone (TTZ) which marks the borders of the precambrian platform of Eastern Europe and the paleozoic platform of Western Europe. One of many of this region's traits is the abundance of dry grasslands. They can be found on the slopes of the major river valleys (Bug, Wieprz, Vistula) and in the limestone outcrops. What remains of the long-time gone steppe vegetation is a large area covered with chernozhems in the SE part of this region - mostly in the Volhynian Upland. The physiographic diversity is also reflected in the species composition of grasslands. In the western part of Lubelskie one can encounter plants such as *Genista tinctoria*, *Polygala amara*, *Berberis vulgaris*, virtually absent in the east. On the other hand, *Cirsium pannonicum*, *Linum flavum*, *Carlina onopordifolia* are rare or absent in the west even though they are found just a few dozens of kilometers further west, beyond the Vistula river valley (in the Małopolska Upland). Additionally, some species are basically exclusive to the eastern part of Lubelskie (*Echium russicum*, *Chamaecytisus albus*, *Gypsophila paniuculata*, *Senecio umbrosus*, *Astragalus onobrychis*, *Hypericum elegans*).

**Oral presentation****♣ Niche of plant species native to the temperate forest biome in Europe matches a heterogenous natural vegetation shaped by megaherbivores****Szymon Czyżewski<sup>1</sup> & Jens-Christian Svenning<sup>1</sup>**

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Traditionally the natural vegetation of the temperate forest biome has been characterized as dense forest. However, recent studies show that prior to human-induced changes the vegetation was more heterogenous including open and semi-open canopy, likely maintained by now extirpated megaherbivores. Native plant species evolved in natural, pre-human ecosystems so their niche preferences should reflect these conditions. We examined whether the niche of plant species native to the temperate forest biome in Europe matches heterogenous vegetation maintained by megaherbivores or dense forest. We first selected all species considered native in Central Europe (Germany and Poland) and forest species (a more conservative nativeness criterion). Subsequently, we summarized data-base information on species preferences for canopy openness and grazing. We converted grazing levels into grazer densities (kg grazer biomass/km<sup>2</sup>) using a published relationship between sheep biomass and percent plant biomass removed. Finally, we explored correlations between the canopy openness niche, its width, disturbance severity, and disturbance frequency. We found that out of all native species 74.4%, and out of forest species 51.9% prefer half-light (30% intercepted light) or more open canopy. Only 16.6% of forest species prefer shade (10% or less intercepted light). Interestingly even within dense-forest specialists (24% of all forest species) 36.4% of species prefer semi-shade (10% intercepted light) or more open canopy. The grazer density preferences were rather similar across all plant species. From all the native plant species 53.7%, and from forest species 48.1% prefer grazer densities higher than 7000 kg/km<sup>2</sup>. Plant species preferring grazer densities from 6000 to 7000 kg/km<sup>2</sup> made up 37.6% of all forest species, 24.6% of all native species, and 77.4% of dense-forest specialists. Furthermore, the degree of open canopy preference was negatively correlated with niche width among native species, which means that light specialists are mostly found in open and semi-open habitats. Within the forest species pool preferences for open canopy were negatively correlated with disturbance severity, and positively with disturbance frequency. This indicates that forest plants rely mostly on frequent, low-severity disturbance events, putting in question the idea that successional stages, resulting from big disturbance events like windthrows, are the key mechanism providing habitat for light-demanding forest plant species. Low severity, high frequency disturbance regimes may have been due to extirpated megaherbivores like elephants and rhinos as well as large bovines and equids, and may have resulted in the chronic presence of open and semi-open vegetation during past warm periods as well as prior to the Pleistocene glaciations. These patterns provide support for a more heterogeneous natural vegetation in the temperate forest biome and indicate that trophic rewilding through the reintroduction of large herbivores may be a solution to maintain the rich European biodiversity connected to semi-open and open vegetation.

## Poster presentation

**Sign of stability or very slow changes? No difference in the level of invasion after a decade neither on primary sandy grasslands nor on old-fields****Anikó Csecserits<sup>1,2</sup>, Boglárka Berki<sup>3</sup>, Zoltán Botta-Dukát<sup>2</sup>, Edina Csákvári<sup>1</sup>, András Mártonffy<sup>3</sup>, Tamás Rédei<sup>2</sup>, Katalin Szitár<sup>2</sup> & Melinda Halassy<sup>1,2</sup>**<sup>1</sup>National Laboratory for Health Security, Institute of Ecology and Botany, Centre for Ecological Research, Budapest, Hungary<sup>2</sup>Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary<sup>3</sup>Eötvös Loránd University, Doctoral School of Biology, Budapest, Hungary[csecserits.aniko@ecolres.hu](mailto:csecserits.aniko@ecolres.hu)

Grasslands are undergoing a permanent changes partly due to land-use change partly due to the spread of invasive alien species. In order to track these changes and follow the dispersal of native and alien species, long-term monitoring is necessary, as this method is the best suitable to reveal slow shifts. In our study, conducted between 2019 and 2021, we repeated a vegetation survey first conducted in primary grasslands and old-fields in the Kiskunság between 2007 and 2009. Our aim was to monitor changes of land use, successional stages, and the level of invasion. We repeated 161 vegetation relevés, 20 m x 20 m large, positioned stratified randomly in 16 sampling sites representing the land-use diversity of the dry part of Kiskunság, Central-Hungary. We reconstructed the land-use based on archive maps and aerial photos, thus those grasslands, which were not ploughed in the last 200 years were considered as primary grasslands. Among the old-fields we distinguished in 2007 three age groups based on the time of abandonment: young (1–7 years old), medium (8–20 years old) and old (21–57 years old). Regarding land use, we found changes only in the case of old-fields; 36% of young, 55% of medium and 90% of old age-group remained old-field. We detected the successional changes: the cover of annual plants in young old-fields decreased after a decade, and the cover of woody species increased in closed primary grasslands. However, the level of invasion did not change, either in primary or in secondary grasslands, which indicates that alien species form a stable part of the vegetation of the Kiskunság, with a larger abundance in old-fields than in primary grasslands. Thus, the life-form composition of old-fields became almost to the same of primary grasslands, however the presence of alien species seems to be a long-lasting phenomenon.

## Oral presentation

**Environmental heterogeneity driven plant diversity on ancient burial mounds in Hungary and Bulgaria**

**Balázs Deák<sup>1</sup>, Bence Kovács<sup>2</sup>, Zoltán Rádai<sup>1</sup>, Iva Apostolova<sup>3</sup>, András Kelemen<sup>1</sup>, Réka Kiss<sup>1</sup>, Katalin Lukács<sup>1</sup>, Salza Palpurina<sup>3,4</sup>, Desislava Sopotlieva<sup>3</sup>, Ferenc Báthori<sup>1</sup> & Orsolya Valkó<sup>1</sup>**

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Environmental heterogeneity (EH) driven species richness has been a central topic in ecology for decades, and can be an important driver of grassland biodiversity in many habitats. Spatial or temporal patterns of environmental factors have a high potential for increasing species richness even within a small area by providing contrasting habitats for numerous species with different environmental needs. Ancient burial mounds of the steppes (the so called 'kurgans') covered by dry grasslands and characterised by diverse topography provide a unique opportunity for studying links between environmental heterogeneity and biodiversity. In our study by using burial mounds covered by semi-natural dry grasslands, we evaluated the effect of EH components (topography, soil and microclimate) on biodiversity and vegetation composition. We designated 16 study sites in Central and Southern Europe, each containing mounds with five microsites (top, north-, east-, south- and west-facing slopes) and a nearby plain grassland. We measured soil moisture, soil chemical properties, solar radiation and microclimate; and recorded the cover of vascular plants. Topographical heterogeneity was associated with sharp differences in microclimate and soil properties. Besides the contrast between mild north-facing and harsh south-facing slopes, east- and west-facing slopes also sustained unique microsites characterised by dynamic diurnal changes in air temperature and vapour pressure deficit. Various combinations of the EH components resulted in unique plant species compositions and supported the co-occurrence of species typical of contrasting habitat types within the mound. Our results suggest that kurgans with complex topography can harbour a high biodiversity and introduce a high level of EH to otherwise homogeneous plain landscapes.

## Poster presentation

**Drivers of plant diversity in grasslands on mineral islands surrounded by peatlands (Biebrza valley, NE Poland)****Iwona Dembicz<sup>1</sup>, Jürgen Dengler<sup>2,3</sup>, Marta Czarnocka-Cieciura<sup>4</sup>, Piotr T. Zaniewski<sup>5</sup>, Katarzyna Skłodowska<sup>1</sup> & Łukasz Kozub<sup>1</sup>**<sup>1</sup>Institute of Environmental Biology, Faculty of Biology, University of Warsaw, Warsaw, Poland<sup>2</sup>Vegetation Ecology, Institute of Natural Resource Sciences (IUNR), Zurich University of Applied Sciences (ZHAW), Wädenswil, Switzerland<sup>3</sup>Plant Ecology, Bayreuth Centre of Ecology and Environmental Research (BayCEER), University of Bayreuth, Bayreuth, Germany<sup>4</sup>National Information Processing Institute - National Research Institute, Warsaw, Poland<sup>5</sup>Department of Forest Botany, Faculty of Forestry, Warsaw University of Life Sciences, Warsaw, Poland  
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We studied both vascular and non-vascular plant fine-scale species richness patterns in dry and mesic grasslands of “mineral islands” in the Biebrza river valley (NE Poland). These mineral islands, mostly dunes formed during at the end of the last glaciation, are surrounded nowadays by large complex of peatlands. Despite their relatively small size (usually a few to several tens of hectares), the mineral islands are local biodiversity hotspots. We asked: (i) what is the species richness of vascular plants, bryophytes and lichens of grasslands and how does it change across different grain sizes? (ii) what are the main environmental factors driving the observed diversity patterns of vascular plants, non-vascular plants (bryophytes and lichens) and rare, red-listed species at the different grain sizes? We sampled environmental data and all vascular plant, terricolous bryophyte and lichen species in 38 nested-plot series with seven grain sizes (0.0001–100 m<sup>2</sup>) located within grasslands on mineral islands in the Middle and Lower Biebrza Basin. To assess the importance of 16 environmental variables as predictors of species richness, we used generalized linear mixed models (GLMMs), generalized linear models (GLM) and multi-model inference. To reduce a risk of overfitting we set a limit of maximum seven predictors in a model. Maximum species numbers in 10 m<sup>2</sup> were 53 vascular plants, 7 bryophytes and 7 lichens. The highest species richness for all taxa together was 7 species in 0.0001 m<sup>2</sup>, 58 in 10 m<sup>2</sup> and 89 in 100 m<sup>2</sup>. The relative importance of different predictors of species richness varied with spatial scale. For vascular plants richness at 10 m<sup>2</sup> among the most important predictors were local factors (e.g. unimodal relationship with moisture and organic content in the soil, negative impact of relative elevation), but surprisingly not soil pH, which in similar analyses from other Eurasian grasslands often was one of the most important predictors. Grazing with domesticated animals had minor importance in all studied groups. Subbasin identity was important for vascular plant and cryptogam richness, while the area of grassland patch was an important, positive predictor only for rare species. Interestingly, the richness of latter group was negatively related with the area of the mineral island. This result suggests that small mineral islands should get special attention in conservations planning and management.



## Oral presentation

**Classification of the high-rank syntaxa of the Balkan dry grasslands with a new hierarchical expert system approach: now finished****Kiril Vassilev<sup>1</sup>, Erwin Bergmeier<sup>2</sup>, Steffen Boch<sup>3</sup>, (...) & Jürgen Dengler<sup>4</sup>**<sup>1</sup>Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia, Bulgaria<sup>2</sup>Albrecht von Haller Institute of Plant Sciences, University of Göttingen, Göttingen, Germany<sup>3</sup>Swiss Federal Research Institute WSL, Birmensdorf, Switzerland<sup>4</sup>IUNR, Zurich University of Applied Sciences (ZHAW), Wädenswil, Switzerland[dr.juergen.dengler@gmail.com](mailto:dr.juergen.dengler@gmail.com)

**Aims:** Developing a hierarchical classification system for classes, orders and alliances of the diverse dry grasslands of the Central and Eastern Balkan Peninsula and translating this into an electronic expert system (ES) for the automatic assignment of plots.

**Location:** Serbia, Kosovo, North Macedonia, Bulgaria and northern Greece.

**Methods:** We extracted 5734 plots from the Balkan Dry Grassland Database corresponding to eight classes of dry grasslands reported from the region, using the EuroVegChecklist Expert System. This dataset and later the plots within each derived subunit were subjected to a new numerical approach: Starting with an initial partitioning (expert-interpreted TWINSpan classification), diagnostic species were determined based on their phi values for the target vegetation type as well as their difference to the vegetation types. These diagnostic species were fed into an ES to create a new partitioning, a procedure which was iterated until diagnostic species and species of the ES converged.

**Results:** The iterative cluster optimisation (ICO) converged in all cases. The resulting hierarchical expert system (HES) classified 95% of all plots to alliances. We distinguished four classes with eight orders and 12 alliances: (1) *Tuberarietea guttatae* (with *Romuleion*); (2) *Stipo-Brachypodietea distachyi* (with *Clinopodio alpini-Thymion striati*); (3) *Festuco-Brometea* with the *Brachypodietalia pinnati* (with *Chrysopogono-Danthonion calycinae* and *Cirsio-Brachypodion pinnati*), *Festucetalia valesiaca* (with *Festucion valesiaca*), an unnamed order of rocky steppes (with *Pimpinello-Thymion zygioidis*) and *Koelerietalia splendentis* (with *Centaureo-Bromion fibrosi*, *Saturejion montanae* and *Diantho haematocalycis-Festucion hirtovaginatae*); (4) *Koelerio-Corynepherea* with the *Sedo acris-Festucetalia* (with *Festucion vaginatae*) and *Trifolio arvensis-Festucetalia ovinae* (with *Armerio rumelicae-Potentillion* and *Minuartio montanae-Poion molinerii* all. nov.).

**Conclusions:** We created a unified hierarchical classification with an electronic ES using diagnostic species defined by phi values. Our new approach (ICO-HES: iterative cluster optimisation for hierarchical expert systems) allows dividing large datasets into meaningful units at several hierarchical levels, and thus has high potential for complex classifications.



## Oral presentation

### ♣ Establishment of *Sporobolus cryptandrus* (Torr.) A. Grey (Poaceae) - a new invasive species in Hungary

**Péter Török<sup>1,2,3</sup>, Dávid Schmidt<sup>4</sup>, Zoltán Bátori<sup>5</sup>, Aradi E.<sup>6</sup>, András Kelemen<sup>6,7</sup>, Alida Anna Hábcenyus<sup>5</sup>, Patricia Diaz Cando<sup>2</sup>, Csaba Tölgyesi<sup>1,5</sup>, Pál R.W.<sup>8</sup>, Nóra Balogh<sup>1</sup>, Edina Tóth<sup>1,2</sup>, Gábor Matus<sup>9</sup>, Táborská J.<sup>10</sup>, Gábor Sramkó<sup>9,11</sup>, Levente Laczkó<sup>9,11</sup>, Sándor Jordán<sup>9,11</sup>, McIntoshné Buday Andrea<sup>1</sup>, Kovacsics-Vári Gergely<sup>2</sup> & Judit Sonkoly<sup>1</sup>**

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Invasive species and climate change pose significant threats to the natural world, and certain C4 grass species with effective dispersal strategies appear to benefit from extreme climatic changes. This study focuses on *Sporobolus cryptandrus*, an invasive C4 grass species originally from North America that has been discovered in Hungary. We aimed to examine its current distribution, characteristics, and potential impacts. Field surveys revealed large stands of *Sporobolus cryptandrus* in Central and Eastern Hungary, particularly in the Kiskunság region. The species has invaded disturbed stands of dry and open sand grasslands, closed dune slack grasslands, and natural open sand grasslands adjacent to disturbed habitats. The increasing cover of *Sporobolus cryptandrus* was found to negatively impact species richness and abundance of subordinate species in both the vegetation and seed banks. However, low densities of the species had a weak positive effect on these characteristics. Viable seeds of *Sporobolus* were found in all soil layers, indicating its ability to form a persistent seed bank. The number of seeds ranged from 1,114 to 3,077 per square meter, increasing with a higher abundance of the species in the vegetation. Germination of *Sporobolus cryptandrus* was hindered by litter cover and 1 cm deep soil burial. The study concludes that *Sporobolus cryptandrus* can be considered a transformer invasive species, posing a high risk to dry sand and steppe grasslands in Eurasia. To effectively suppress its spread, the researchers recommend clarifying the origin of detected populations, assessing its competitive ability and potential allopathic effects, evaluating its seed bank formation potential in various abiotic conditions, and exploring the possibility of suppression through natural enemies and management techniques like mowing or livestock grazing. In summary, this study sheds light on the distribution, characteristics, and ecological impact of the invasive species *Sporobolus cryptandrus* in Hungary. It emphasizes the need for further research and management strategies to mitigate the risks associated with its invasion.

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**Poster presentation****Seed-based grassland establishment in solar parks - combining renewable energy production with ecosystem services associated with pollinators****Sandra Dullau<sup>1</sup>, Pascal Scholz<sup>1</sup>, Maren Helen Meyer<sup>1</sup> & Sabine Tischew<sup>1</sup>**

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In recent years, landscapes in many countries have been transformed by efforts to fight global warming, specifically the shift towards renewable energies. Photovoltaics is one of the key technologies for reducing greenhouse gas emissions and achieving climate neutrality for Europe by 2050, which has led to the promotion of solar parks. Due to the ambitious goals for the expansion of photovoltaics, a multiple of the area used so far will be built on with solar parks. These parks can span up to several hundred hectares, and grassland vegetation is usually created between and under the panels. In most cases, this is done by spontaneous revegetation or by seeding species-poor mixtures dominated by grasses. Establishing species-rich grasslands using native seed mixtures can enhance a variety of ecosystem services, including pollination. We present a multi-step concept for designing native seed mixtures to promote pollinators, especially wild bees, in solar parks. It takes into account the specific site conditions (climate, soil type, reaction and nutrient level), the small-scale modified conditions caused by the solar panels (light availability), the requirement to avoid panel shading (growth height), as well as seed market and economic considerations (costs, seed availability). The final step focuses on the requirements to promote pollinators (flower colors, flowering period, plant families and vegetation structure). Furthermore, we provide an easy-to-use index for determining the value of native seed mixtures for wild bee enhancement and apply it as an example to several grassland mixtures specifically designed for solar parks. While species richness and forb percentage have a strong influence on the index value, species selection, which differs between solar parks due to their very diverse site conditions, has only a minor influence.

## Poster presentation

**Ancient burial mounds provide ecosystem services by preserving medicinal plants from grasslands****Rita Engel<sup>1</sup>, Orsolya Valkó<sup>1</sup>, Kristóf Süveges<sup>1</sup>, Ádám Bede<sup>1</sup> & Balázs Deák<sup>1</sup>**

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Medicinal plants provide several ecosystem services in different levels of human wellbeing. On the one hand they are collected and used locally to treat diseases based on traditional knowledge. On the other hand there are worldwide used pharmaceutical products derived from medicinal plants. Medicinal plants have also a key role in health preservation. Beyond the health aspect, medicinal plants serve as important food sources for pollinators. The biodiversity of this multifaced plant group is endangered by various anthropogenic effects. Due to the high level of landscape transformation, area of natural habitats – such as dry grasslands – holding many medicinal plants have been decreased in many regions. However, the remaining grassland fragments can still serve as safe havens for grassland related medicinal plants. In cultivated landscapes, road verges, field margins, rocky outcrops, and other small natural sites can function as grassland islets. In continental parts of Eurasia 'kurgans' (ancient earthen burial mounds) are one of the most widespread small natural features that can preserve grassland related species despite the high level landscape transformation, and due to their high environmental heterogeneity can hold a high biodiversity. In our study, we investigated how kurgans might provide ecosystem services related to medicinal plant preservation. We used vegetation data from 178 kurgans in Hungary. The surveyed kurgans represented a gradient regarding grassland age: We surveyed kurgans with ancient several millennia old grasslands, but also kurgans with old fields. We aimed to reveal how grassland age, kurgan area, percentage of cropland cover in the landscape can affect medicinal plant diversity and cover on kurgans. On the studied mounds we recorded 164 medicinal plant species in total, including 42 species listed in pharmacopoeias or herbal monographs. Among the medicinal plants 42 species were grassland specialist. The number of medicinal plants ranged from 5 to 34 on the kurgans (the median was 19.5). Our results showed that the area of mounds did not influence the total cover and composition of medicinal plants. With increasing age of mounds the species richness of perennial medicinal plants increased considerably. High percentage of cultivated land surround the mounds increased the species richness of short-lived medicinal plants. Our results suggest that, kurgans regardless of their area or age provide favourable environmental conditions for several medicinal plants, but with different composition. Thus, conservation of ancient earthen burial mounds can considerably contribute to the preservation of local medicinal plants typical to grasslands and old fields. Our further aim is to map the chemical diversity of medicinal plants from kurgans.

## Poster presentation

♣ **Restoration and management of urban grasslands – a global review****Réka Fekete<sup>1,2,3</sup>, Orsolya Valkó<sup>1,4</sup>, Balázs Deák<sup>1,4</sup> & Valentin H. Klaus<sup>5</sup>**

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Since urbanization is one of the greatest threat to biodiversity, the need to involve urban areas in restoration actions is increasing globally. Semi-natural grassland could be created at several urban sites like parks, playgrounds, brownfields, wastelands or vacant lots. Furthermore, intensively managed urban lawns could also be involved in restoration with a cost-effective method, the reduction of management intensity. These lawns can potentially serve as important habitats for several grassland specific taxa and support biodiversity. In our review we aimed at evaluating the possibilities and methods for urban grassland restoration and biodiversity-friendly management. Our selection criteria were the following: the article should examine an active intervention related to grasslands in urban sites, and it should compare the effects of the interventions on grassland specialist organisms. Altogether we evaluated the results of 48 relevant studies from four continents, but most of the studies originated from Europe (30). Mostly large cities were chosen for the surveys, since 30 studies were carried out in cities with a population between 100,000 and 1,000,000. Studied sites were mostly urban grasslands (including intensively managed urban lawns) with 1-10 sites examined per study. Surveyed taxa were mostly plants and invertebrates. Motivation of almost all of the studies was the enhancement of urban biodiversity, and they investigated effects of burning, mowing, seeding, and planting in some cases combined together, or with other management actions. The effects of different mowing regimes were examined in most of the studies (27) followed by seeding (14). Out of the 27 studies 23 found that reduction of mowing intensity increases the abundance or species richness of the surveyed taxa or enhances the establishment of target vegetation. Among studies investigating seeding as an intervention, eight study found that seeding native species enhanced the success of the studies. These results support the case for the restoration of urban grasslands and demonstrate that urban areas can also play an important role in biodiversity conservation and is worth investing in their restoration. On the other hand, from the point of view of urban maintenance, they emphasize the importance of using a cost-effective method, namely reducing the intensity of management, which is beneficial not only for wildlife but also for the budgets of stakeholders.

## Poster presentation

## Syntaxonomy of subalpine meadows of the Borzhava mountain massif (Ukrainian Carpathians)

**Lyubov Felbaba-Klushina<sup>1</sup> & Alina Huklivska<sup>1</sup>**

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The Borzhava mountain massif is the central part of the Polonyn ridge and stretches from the southeast to the northwest for 17 km. Its highest peak is Mount Stoy (1681 m). The rapid development of the highlands of the Ukrainian Carpathians and the Borzhava massif, in particular, over the past decades complicates the natural processes of vegetation development, leads to the loss of biodiversity, the destruction of soil and vegetation cover, and the disappearance of relict primary communities of subalpine meadows (Berezhnoi, 1964; Felbaba-Klushyna, Bizilya, 2015). The vegetation of the Borzhava highlands was not the subject of separate geobotanical studies, and some information about it is based on geobotanical descriptions made by K.A. Malinovsky in the period 1943-1961 (Malinovsky, Krichfalushiy, 2001). On the basis of the authors own research, which has been ongoing since 2020 and until now, as well as literary data, which were mostly confirmed by our research, in the subalpine belt of the Borzhava massif there are communities of meadow vegetation that belong to three classes, five orders, seven unions and to nine associations. Below we present the classification scheme of the highlands meadow vegetation within the Borzhava massif. For the first time, *Luzuletum obscurae* associations were found for the studied area. The communities of *Cetrario-Festucetum airoidis* association are most widespread, which are localized on the flat tops and slopes of minor exposure of the Gemba, Zhid-Magura, Plai, Velikiy Verkh, Stoy mountains.

### **SALICETEA HERBACEAE BR.-BL. 1948**

*Salicetalia herbaceae* Br.-Bl. in Br.-Bl. et Jenny 1926

*Festucion picturatae* Krajina 1933 corr. Dúbravcová 2007

*Festucetum picturatae* Krajina 1933 corr. Malinovskiy et Krichfalushiy 2000

*Luzuletum obscurae* Szafer et al. 1927 corr. Dúbravcová 2007

*Potentillo-Polytrichetum communis* Malinovskiy et Krichfalushiy 2000

### **JUNCETEA TRIFIDI HADAČ IN KLIKA ET HADAČ 1944**

*Caricetalia curvulae* Br.-Bl. in Br.-Bl. et Jenny 1926

*Potentillo ternatae-Nardion* Simon 1958

*Phleo alpini-Nardetum strictae* Klika 1934

*Juncion trifidi* Krajina 1933

*Cetrario-Festucetum airoidis* Jenik 1961 corr. Malinovskiy et Krichfalushiy 2000

*Festucetalia spadiceae* Barbero 1970

*Nardion strictae* Br.-Bl. 1926.

*Soldanello-Nardetum* Kricsfalusy et Malynovski 2000

### **MULGEDIO-ACONITETEA HADAČ ET KLIKA IN KLIKA ET HADAČ 1944**

*Calamagrostietalia villosae* Pawlowskyi et al. 1928

*Trisetion fuscii* Krajina 1933

*Poo chaixii-Deschampsietum* Pawlowskyi et Walas 1949

*Vaccinio myrtilli-Calamagrostietum villosae* Sillinger 1933

*Senecioni rupestris-Rumicetalia alpini* Mucina et Karner in Mucina et al. 2016

*Rumicion alpini* Scharfetter 1938

*Rumicetum alpini* Beger 1922

## Poster presentation

**Ectomycorrhizal fungi in a Pannonian sandy forest steppe landscape: a comparison of open and closed grasslands and poplar woodlands****József Geml<sup>1,2</sup>**<sup>1</sup>ELKH-EKKE Lendület Environmental Microbiome Research Group, Eszterházy Károly Catholic University, Eger, Hungary<sup>2</sup>Research and Development Centre, Eszterházy Károly Catholic University, Eger, Hungary  
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Ectomycorrhizal (ECM) fungi are among the most diverse and dominant fungal groups in temperate ecosystems. In Pannonian biogeographic region, they are most diverse and abundant in forest ecosystems. Nonetheless, they constitute an ecologically important and little-studied group of organisms in steppe ecosystems with woody plants, where they likely play crucial roles in the water and nutrient supply of their hosts. The forest steppe vegetation in central Hungary is a mosaic of open grassland communities on sand dunes, closed interdune grasslands, and open woodlands. The primary woody plants forming associations with ECM fungi in these habitats are the sprawling needle sunrose (*Fumana procumbens*), the rosemary-leaved willow (*Salix rosmarinifolia*), and the white poplar (*Populus alba*), respectively. The topic of this presentation is a pilot study to assess the diversity and community composition of ECM fungi in the above habitats in a well-preserved steppe in the Kiskunság National Park in central Hungary, based on DNA metabarcoding of fungi from soil samples. The data shows that ECM fungi associated with *Fumana* on open sand dunes include several species in the genera *Deastria*, *Geopora*, *Inocybe*, while *Cenococcum*, *Cortinarius*, *Geopora*, *Hebeloma*, *Inocybe*, *Sebacina*, *Tomentella*, and *Tuber* species dominate ECM fungal communities in soils around *S. rosmarinifolia* and *P. alba*. Species richness of ECM fungi is greatest under interdune willows and in white poplar woodlands with 25-45 species found per sample, while ECM fungal communities in the sandy soil around *Fumana* typically have less species, only 3-10 per sample in our data. Several ECM fungal genera showed significant differences in richness and read abundance among habitats and exhibited compositional differences, presumably driven by environmental factors and possibly by host preference. Despite shared fungal genera and similar diversity, the composition of willow- and poplar-associated ECM fungal communities differed substantially at species level. Overall, our pilot study shows that ECM fungi are moderately diverse in the sand forest steppes of central Hungary and occupy niches along a moisture gradient ranging from the subarid sand dunes to the more mesic interdune grasslands. Further studies are undoubtedly needed for a more thorough characterization of ECM fungal communities in Pannonian forest steppes.

**Acknowledgements:**

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## Poster presentation

**♣ Vegetation of mound-building mouse mounds in two different habitat types****Laura Godó<sup>1</sup>, Sándor Borza<sup>1,2,3</sup>, Orsolya Valkó<sup>1</sup>, Réka Kiss<sup>1</sup>, Katalin Lukács<sup>1</sup>, Attila Ferenc<sup>4</sup>, Balázs Deák<sup>1</sup>**<sup>1</sup>Lendület' Seed Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research<sup>2</sup>Juhász-Nagy Pál Doctoral School, University of Debrecen, Debrecen, Hungary<sup>3</sup>Hortobágy National Park Directorate, Debrecen, Hungary<sup>4</sup>Bükk National Park Directorate, Eger, Hungary[godolaura0306@gmail.com](mailto:godolaura0306@gmail.com)

Numerous mammal species alter the characteristics of their habitat through their activities (such as soil disturbances). Soil disturbance by these animals mix and loosen soil layers, redistribute nutrients and create free microhabitats which can have significant impacts on the vegetation. The type of the habitat may influence the response of vegetation to disturbance. The mound-building mouse (*Mus spicilegus*) inhabits grasslands and agroecosystems from eastern Austria to western Russia. In autumn, one mice family builds a 50-400 cm diameter mound from plant material covered by soil. The mice leave behind the mound in spring and the vegetation can develop on it. The aim of our research was to determine the effect of the mound-building activity of mound-building mice in different habitat types (mowed oldfield and alfalfa field). We had 6 sample sites in each habitat type in the Hungarian Great Plain, where we conducted a vegetation survey on 5 mound-matrix pairs per sites. Our results suggest that the activity of the mound-building mouse caused significant changes in habitat conditions and created suitable microhabitat for plant establishment. We found that the vegetation of the mounds differed significantly from the surrounding matrix in many aspects. On the mounds, mainly the disturbance-tolerant annual species were able to establish. The habitat type influenced the level of differences between the vegetation of the matrix and the mound.

**Oral presentation****Reducing the establishment of seedlings of invasive alien species by sowing high density or competitive native species****Melinda Halassy<sup>1,2</sup>, Anikó Csecserits<sup>1,2</sup>, Anna Cseperke Csonka<sup>3</sup>, Nóra Sáradi<sup>1,2</sup>, Katalin Török<sup>1,2</sup>, Orsolya Valkó<sup>1,2</sup>, Márton Vörös<sup>2,3</sup> & Edina Csákvári<sup>1,2</sup>**<sup>1</sup>National Laboratory for Health Security, Institute of Ecology and Botany, Centre for Ecological Research, Budapest, Hungary<sup>2</sup>Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary<sup>3</sup>Eötvös Loránd University, Doctoral School of Biology, Budapest, Hungary[halassy.melinda@ecolres.hu](mailto:halassy.melinda@ecolres.hu)

Invasion of alien species is a major driver of biodiversity loss. Ecological restoration is key to invasion control and improving biotic resistance of restored communities. We investigated the possibility of controlling the establishment of invasive alien species by adding native species. We tested if trait similarity (four species) or increased propagule pressure (12 seeds or 60 seeds) of native species can result in the suppression of seedling emergence of invasive species at the early stage of development. We set up a greenhouse experiment in September 2021 with three invasive alien species (*Asclepias syriaca*, *Conyza canadensis*, *Tragus racemosus*) that are widespread in sandy grasslands in Hungary. We selected the native species based on their multi-trait similarity to the invasive species, plus added a competitive grass species and the mixture of all species. We counted emerging seedlings for 9 weeks from 20 October 2021 to 15 December 2021, then additionally in March and April 2022. We tested the impact of species identity, propagule pressure and their interaction on maximum seedling emergence using univariate general linear models. We found that the establishment of invasive seedlings can be reduced by the addition of native species at high densities, but also depending on species identity. Instead of species of similar traits, the seeding of a competitor perennial grass of sand grasslands (*Festuca vaginata*) reduced the seedling emergence of all studied invasive species the most. Our results confirm that invasive species can be effectively controlled at the early establishment stage by adding native seeds, especially using higher density and competitive species. We conclude that invasion-resistant restoration can be achieved through a combination of factors, including high-density sowing of native species that can overgrow invasive species at an early stage of development.



## Poster presentation

**Degradation and re-gradation of meadow's plant species diversity under different management pressure at the unique *Adenophora liliifolia* locality****Romana Prausová<sup>1</sup> & Roman Hamerský<sup>2</sup>**

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The aim was the restoration of degraded meadows by the village of Babiny in České středohoří Mts. Unique, species-rich, dry, mesophilous and wet meadows (core of the vegetation cover is represented by xeromesophytes) form a mixture of different heights plant species elements ("forest-meadow steppe"). Their specific status was studied by several authors, ex. Domin (1904), Šimr (ex. 1929, 1939). These meadows differ from others typologically, show distinct diosyncrasy from the others in Czechia. Until the beginning of the 20th century were known as "orchid meadows", similar those in Bílé Karpaty region (Martinovský, 1967). During the 20<sup>th</sup> century majority of rare species were lost. These meadows are known as a specific site of *Adenophora liliifolia* occurrence. Suitable meadow management, based on regular mowing was changed during the 2000<sup>th</sup>. Management practices, based on preferred support of *Sanguisorba officinalis* (food plant source for target species *Phengaris nausithous*) resulted in plant communities' rapid degradation and *Adenophora liliifolia*'s abundance loss. Improper management resulted in fast expansion of *Calamagrostis epigejos*, and accelerated decrease of recorded species's diversity. Newly practiced management methods (terms of mowing and raking, use of hemi parasite *Rhinanthus alectorolophus* to eliminate dominating grasses, fencing against grazing and digging of deer, fallow deer, wild pigs etc.) led to the increase of natural vascular plants coverage. After five years of intensive management have the herbs species abundance and the size of *Adenophora liliifolia* population increased (38 bunches – 2019, 52 bunches – 2023). Unexpectedly, the number of *Sanguisorba officinalis* individuals increased rapidly (cover <1 % in 2019, <5 % in 2023), supporting expected reproduction of *Phengaris nausithous* population. Plant species abundance at restored plots reaches currently nearly 60 plant species/25 m<sup>2</sup>. The cover of grasses has decreased (cover 61–80 % before 2019, 14–24 % after 2019), while low sedges, rushes and woodrushes (cover 4–5 % before 2019, 13–28 % after 2019) and herbs (cover 16–24 % before 2019, 38–75 % after 2019) increased their coverage. While decrease of the damaged stems number by deer's grazing thanks to the fence was expected (4–14 stems before 2019, 0 % after 2019), the intensity of invertebrates' grazing increased after building of protecting fence (0 % before 2019, 11–30 % after 2019). Specific management carried out by *Rhinanthus alectorolopus* growth should only be used temporally until the number of flowering plants will exceed the number of grasses (40–75 % of herbs, 15–22 % of grasses). It is necessary carefully consider pros and cons of each realized management measurement and adapt practical management according to the regular monitoring results.

## Poster presentation

**AveWetlands – a new project to assess the annual vegetation diversity of European wetlands****Svitlana Iemelianova<sup>1,2</sup>, Milan Chytrý<sup>1</sup> & data contributors**<sup>1</sup>Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic<sup>2</sup>M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, Kyiv, Ukraine[yemelianova.sv@gmail.com](mailto:yemelianova.sv@gmail.com)

Annual wetland vegetation is a specific plant community dominated by therophytes (annual plants) and dwarf geophytes with a short life cycle and the ability of long-term survival in dormant propagules. It develops in highly dynamic habitats with rapidly changing environmental conditions due to alternating periods of flooding and dryness of the surface. Annual wetlands have high floristic diversity and harbour extremely rare species and plant communities. AveWetland is a new EU-funded project aimed to develop a large-scale synthesis of annual vegetation of European wetlands and provide its comprehensive characteristics in terms of syntaxonomic diversity, habitat affiliation, geographical distribution, and the level of alien plant invasions. The main project questions are *which habitats* do the annual wetland vegetation occupy, *what is the diversity* of its plant communities in Europe and *what are the patterns* of plant invasions across European annual wetlands. Building on data selected within global community-shared sources (European Vegetation Archive (Chytrý et al. 2016)), and private databases provided by researchers across all Europe. AveWetlands will allow to (i) make a detailed syntaxonomical revision of annual wetland vegetation, remove all gaps in knowledge and solve controversial issues; (ii) assess the level of alien plant invasion as a mirroring of the annual wetlands affection scope by anthropogenic pressure and global processes. By implementing the planned research, we expect to get a comprehensively revised classification of annual wetland vegetation at the alliance and association levels across Europe, a computer expert system for the automatic vegetation classification, uniformly interpreted and integrated into the EUNIS Habitat Classification system annual wetlands habitat type. Moreover, we will identify the main biological threats to annual wetlands.

Chytrý M., Hennekens S. M., Jiménez-Alfaro B. et. al. 2016. European Vegetation Archive (EVA): an integrated database of European vegetation plots. *Applied Vegetation Science*. 19: 173–180.

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**Oral presentation****How many livestock are needed to maintain EU priority habitats?****Gwyn Jones<sup>1</sup>, Julia Wiese<sup>1</sup> & Jan-Erik Petersen<sup>2</sup>**<sup>1</sup>European Forum on Nature Conservation and Pastoralism, Lampeter, UK<sup>2</sup>European Environment Agency[gwyn@efncp.org](mailto:gwyn@efncp.org)

Most current assessments of livestock production give it a negative score, reflecting the environmental impact of intensive livestock production, yet extensive grazing practices have created much of Europe's landscapes and semi-natural habitats. Hence the conservation objectives of the Habitats Directive and the proposed Nature Restoration Regulation will require maintaining and potentially expanding extensive grazing practices across Europe. Annex 1 of the Habitats Directive lists those habitats considered of such significance that EU Member States must designate and manage Special Areas for Conservation to ensure their favourable condition. Some of the semi-natural habitats in Annex 1 are dependent on agricultural management for their maintenance in at least part of their range – mowing in some cases, but mostly grazing by livestock. Ole Ostermann's initial list (Ostermann, 1998) was updated following EU expansion by Ľuboš Halada (Halada et al. 2011) and colleagues and currently contains 64 habitats. A key question for the delivery of nature policy and its effective and coherent integration with agriculture and rural development policy is how many livestock the effective maintenance of those habitats would imply. The authors have attempted to estimate for the first time the total livestock requirement at habitat, Member State and EU level using habitat extent data provided by Member States in their 'Article 17' reports and European experts' estimates of the grazing needs of each habitat for each biogeographical region. The presentation sets out the methodology, some of the difficulties encountered and preliminary results.

Halada L, Evans D, Romão C & Petersen J-E (2011) Which habitats of European importance depend on agricultural practices? *Biodiv. and Cons.* 20: 2365–2378

Ostermann OP (1998) The need for management of nature conservation sites designated under Natura 2000. *J Appl Ecol* 35: 968–973

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**Oral presentation****♣ The role of livestock grazing and connectivity in recovery of grassland communities following restoration****Rozália Kapás<sup>1</sup>, Adam Kimberley<sup>1</sup> & Sara Cousins<sup>1</sup>**<sup>1</sup>Department of Physical Geography, Stockholm University  
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**Background** Large-scale changes in the landscape decreased the extent of grassland habitats over the last century. Restoration efforts to counteract the loss of grasslands are high on the agenda across the globe and there is a pressing need to understand the drivers behind the recovery of grasslands. Restorations mainly rely on the spontaneous dispersal of the plant species from source of the local and landscape scale and recovery of grassland is governed by different factors and drivers, which interact over time and across scale. To increase the efficiency in the recovery of grassland communities, more knowledge on effective dispersal and establishment of target species and its relation to post-restoration management is required.

**Methods** We examined the recovery of grassland communities in Swedish grasslands by surveying plant communities across temporal and spatial scales with contrasting management and former land-use type.

**Results** We found that species mostly established spatially from the local species source through seed rain following restoration and seed bank was contributed more to the regeneration of the species on grasslands with long-continuity of management. Management thorough livestock grazing and connectivity to propagules sources were positively correlated with the number of species found in grasslands. By directly examining the species assembly following restoration, we found that plant species associated with former land-use declined from restored areas, while the occurrence of target species are generally increased, but there was a high stochasticity in establishment of target species at the initial phase and took several decades to recover to the level of the target community.

**Conclusions** The observed patterns show that nearby species-rich grassland serve as a source of species and livestock grazing is an important driver of the grassland recovery. Hence, the presence of animals is necessary to reach intended target communities together with well-connected restoration targets and the propagule sources in the landscape. The recovery of grassland communities, hence the establishment and persistence of target species can be only achieved with active management and by conserving the remaining ancient grasslands which are hotspots for colonizing species.

## Poster presentation

**Using species distribution modeling to design conservation strategies for the European roller****Orsolya Kiss<sup>1,2</sup>, Béla Tokody<sup>2</sup> & Zsolt Végvári<sup>3</sup>**<sup>1</sup>Institute of Animal Sciences and Wildlife Management, Faculty of Agriculture, University of Szeged, Hódmezővásárhely, Hungary<sup>2</sup>BirdLife Hungary/MME, Budapest, Hungary<sup>3</sup>Institute of Aquatic Ecology, Centre for Ecological Research, Budapest, Hungary  
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Habitat loss and climate change are the most important drivers of biodiversity decline. Birds of grasslands and farmlands, especially long-distance migrants have been highly affected by these factors, showing large population both in Europe and North America. The European roller (*Coracias garrulus*) is a secondary cavity nester species that use grasslands and extensive farmlands as foraging site and large trees with cavities as nesting sites, but it avoids closed forests. This species has suffered large declines both in size and range of the population in Europe, and it is still extinct or declining in several countries, although, direct conservation actions successfully reversed this negative trend locally. Besides, climate change is predicted to have a negative impact on the majority of the large roller population in Europe. Hungary has a significant and increasing population of the European roller, however, the spatial distribution of the species is still much smaller than it was in the 20<sup>th</sup> century. Here, we aimed to use species distribution modeling (SDM) to evaluate the current habitat suitability of the historical breeding area of the species in Hungary to promote the recolonization and the enlargement of the breeding range in the Carpathian basin. We also aim to evaluate the potential significance of the European Union's nature protection network, the Natura 2000 sites in this process. We found that the most important predictors were the grasslands, broad-leaved forests, and agriculture sites with significant natural areas. We found that the majority of areas predicted suitable for rollers was without current nest-box occupancy data. A significantly larger proportion of grid cells with archive data still preserve suitable land cover composition for rollers than cells where the former breeding wasn't confirmed, and only a small proportion of the former breeding area has become completely unsuitable for the species. The results indicate large overlaps between the Natura 2000 network and the predicted suitable area for rollers, of which 28.3% overlaps with Special Protection Area (SPA) sites and 23.8% with Special Area of Conservation (SAC/SCI) sites. Our results highlight the importance of promoting nest-box supplementation program in the western region of Hungary. We also suggest that the Natura 2000 network can potentially serve as core areas in the recolonization processes. Our study also proved that species distribution modeling could be a useful tool for direct conservation planning.

## Poster presentation

**♣ Effect of climatic parameters on the population dynamics of *Bulbocodium vernum*****Réka Kiss<sup>1</sup>, Katalin Lukács<sup>1,2</sup>, Laura Godó<sup>1</sup>, Ágnes Tóth<sup>3</sup>, Tamás Miglécz<sup>4</sup>, László Szél<sup>5</sup>, László Demeter<sup>5</sup>, Orsolya Valkó<sup>1,2</sup> & Balázs Deák<sup>1</sup>**<sup>1</sup>'Lendület' Seed Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research<sup>2</sup>National Laboratory for Health Security, Centre for Ecological Research<sup>3</sup>Department of Ecology, University of Szeged<sup>4</sup>Hungarian Research Institute for Organic Agriculture<sup>5</sup>Hortobágy National Park Directorate[kiss.reka@ecolres.hu](mailto:kiss.reka@ecolres.hu)

The spring meadow saffron, *Bulbocodium vernum* L. is an early spring geophyte with a disjunct distribution from the Pyrenees to the Caucasus and to the Lower Volga region. It is a relict of the postglacial period with a Mediterranean origin and in its eastern distribution area it can be found in the steppe and forest-steppe region in lower altitudes. It is marked as 'Vulnerable' in the Carpathian Basin, in Hungary is strictly protected and has only few, isolated populations. The populations of the species decline fast in Hungary and the reason is unknown. In the past it was over-collected, in the present the reason may be unfavourable management and changes in climatic conditions. In our study we aimed to study the effect of climatic parameters on the *Bulbocodium vernum* population located near Debrecen, East-Hungary. We established 20 permanent plots in 2018 and surveyed yearly since then three times per year: in March (counting flowering individuals), April (counting all individuals) and May/June (determining capsules production success). As the leaf number of individuals can be an indicator of individuals maturity stage and vitality, during the survey in April we classified individuals according to their leaf number. We also photo-recorded the permanent plots in April for further analyses, when plants were individually marked. We tested the effect of actual year's weather parameters on the number of flowers and individuals, as well as to the success of capsule production. We also used weather parameters from preceding year's vegetation period (March-June) on the number of flowering and non-flowering individuals. Weather data were collected from the Hungarian Meteorological Service database. During the six study years we identified in total 1069 individuals. The total number of individuals was similar across the years, however, significant differences were found in case of leaf number categories, number of flowering individuals and success of capsule-production. We found that climatic parameters affected the studied variables but in a lower degree than we expected. Other, unmeasured parameters may have a stronger effect on the population-dynamics of *Bulbocodium vernum* than climatic parameters.

## Poster presentation

**♣ Effect of increasing intensity of sheep grazing on the biomass composition of acidic sand grasslands**

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The adequate management of domestic grazing has a great importance in terms of grassland biodiversity. We studied the effect of sheep grazing on sand grassland vegetation along an intensity gradient. 15 sites were selected in the Nyírség region, East Hungary. Sites were grazed by sheep or excluded from grazing. Beyond grazing intensity, proximity to frequently used places (e.g., watering place) and quantity of dung were also taken into account when we classified the intensity levels. We designated 10 m × 10 m areas in which ten 20 cm × 20 cm plots were randomly selected for biomass collecting. Soil samples were also collected which were randomly selected within the 10 m × 10 m areas. For analyses, plant trait data (life form, social behaviour type) were collected using locally collected measurement of plant species stored in the Pannonian Database of Plant Traits (PADAPT). We found that with the increase of grazing intensity both litter and green biomass decreased, but for species richness no clear trend was detected. We found that there is a humped-shaped relationship between green biomass and species richness, but the plots with different grazing intensity were not clustered along the humped-shaped curve. Along the intensity gradient, significant differences were detected for the biomass of perennial forbs and graminoids as well as for short-lived forbs which were mainly disturbance-tolerant species. The biomass of short-lived forbs peaked at the highest grazing intensity. Our results suggest that the sand grasslands are particularly sensitive to the increased grazing intensity which comes with a successful colonization of short-lived, disturbance-tolerant plants.



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**Oral presentation****The importance of extreme drought and chronic change in precipitation in a grassland field experiment****György Kröel-Dulay<sup>1</sup>, Gábor Ónodi<sup>1</sup>, Miklós Kertész<sup>1</sup>, Andrea Mojzes<sup>1</sup> & Katalin Szitár<sup>1</sup>**

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Changing frequency of extreme events and changing mean climate are two major components of climate change, yet they are usually studied separately. Since extreme events today act in an already changing climate, it is unclear what the net effects of extreme events and changing climatic means are. In a field experiment we investigated the individual and combined effects of a single extreme drought event and chronic change in precipitation, including both precipitation increase and decrease, in a temperate grassland of high conservation value in Central Hungary. Experimental extreme drought alone caused a major drop in productivity and a shift from perennial grass dominance to annual species. Chronic moderate decrease in precipitation also led to shift to annuals species, whereas increased precipitation resulted in denser grassland and drop in species richness. Overall, the effects of extreme drought were transitory, but under dry condition (rain exclusion) extreme event sped up vegetation shift to annual grassland, whereas under wet condition (watering) extreme event slowed down vegetation change to a denser grassland. Our results suggest that in spite of the striking immediate effects of extreme events, changing climatic means may soon override the effects of extreme events, and extreme events may often be just the modulators of change that would happen anyway in a changing climate.

## Poster presentation

**Comprehensive approach to restoration of dry Mediterranean grasslands on Dinara with the aim of preserving Natura 2000 target bird species**

**Lucija Rajčić<sup>1</sup>, Ivan Budinski<sup>2</sup>, Tomislav Hudina<sup>2</sup>, Luka Škunca, Ivana Selanec<sup>2</sup>, Zdravko Budimir<sup>2</sup>, Tomislav Sotinac<sup>2</sup>, Sven Ratković<sup>3</sup>, Zoran Šunjić<sup>4</sup>, Josip Leto<sup>1</sup> &  Hrvoje Kutnjak<sup>1</sup>**

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As a part of Dinaric arc, situated on the border between Croatia and Bosnia and Herzegovina, Dinara massif comprises three mountains – Dinara, Troglav and Kamešnica. The Croatian part of the Massif lies in the region called the Dalmatian hinterland. Recently, in 2021, Dinara Nature Park was established, covering 63052.2 ha of the Massif. About 55000 ha of Nature Park are covered by Natura 2000 network. Grasslands cover almost 50% of the area of Nature Park dominated by three grassland habitat types. Submediterranean Dry Grasslands (62A0) are dominant on altitudes lower than 900 m. Alpine and subalpine calcareous grasslands (6170) are prevalent over 900 m. Semi-natural dry grasslands and scrubland facies on calcareous substrates (6210) are found in northwestern parts of the area. Dinara was traditionally a livestock-keeping area. Millennial traditional transhumance was abandoned during the second half of the 20<sup>th</sup> century due to the migration of people from land to cities and industrialization in former Yugoslavia. Dinara Massif was an important strategic location of Homeland War in the 1990s and the consequences of the war (such as landmines) furthermore regressed the state of agriculture in the Massif. By 2020, many grasslands and former agriculture plots were overgrown, particularly by prickly juniper (*Juniperus oxycedrus* L.). Farming infrastructure, such as droves and ponds, was damaged. „Dinara back to LIFE" project was launched in 2020 with the main goal of restoring grasslands on Dinara Massif so that local people could sustainably use them for livestock farming and to restore and increase biodiversity. Special emphasis was put on Natura 2000 bird species Stone Curlew, Ortolan Bunting and Short-Toed Lark whose populations in recent years declined due to habitat loss. The local action group was involved in the project to facilitate the inclusion of local communities. The goal was to restore at least 280 ha of dry grasslands by methods of shrub clearing, controlled burning and grazing. Shrub clearing was successfully performed on 90 ha of land. Contracts were signed with six family farms that committed to mixed-grazing of over 507 ha of land. The project helped the family farms buy equipment (electric fences) and livestock. Donkeys, of whom 14 were purchased through the project, are especially important for the outcomes since they feed on prickly juniper. 25 watering places were renovated to accommodate the shepherd's need for water. Controlled burning was performed twice clearing in total 50 ha of overgrown grasslands. Throughout the project over 70 biomass samples were taken and their chemical composition was determined. Images were obtained using UAVs. This data is currently used for creating a pastoral map of the area. The map will be publicly available and is expected to be used by the Nature Park staff in drafting its management plan, as well as by the local authorities in sustainable grassland management planning.

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**Oral presentation****Ancient stone burial mounds as refuges against grassland degradation****Rocco Labadessa<sup>1</sup>, Leonardo Ancillotto<sup>2,3</sup>, Saverio Vicario<sup>1</sup>, Cristina Tarantino<sup>1</sup> & Maria Patrizia Adamo<sup>1</sup>**

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Ancient burial mounds have been recently acknowledged as valuable biodiversity havens, with particular regards to *kurgans* of Eastern Europe and Central Asia. However, little is known about the value of stone burial mounds (cairns) spread in Western and Mediterranean European grassland landscapes, considering their potential role as refuges against degradation processes that may affect grassland vegetation of conservation concern. Here, we compared vegetation data from stone burial mounds and their surrounding grassland matrix in a Bronze Age necropolis (2800-2700 y.a.) that was recently affected by the coupled impacts of grazing abandonment and wild boar rooting activities. We sampled plant species cover in 1m<sup>2</sup> plots and concentric ring plots (65 m<sup>2</sup>) within 15 stone burial mounds and their surrounding matrix, in San Magno necropolis, in Alta Murgia (Southern Italy). Within each pair of mound vs. matrix vegetation plots, we quantified the change in plant species cover and community parameters (richness, life forms and specificity for peculiar vegetation types). Beta-diversity was measured as species turnover between each 1m<sup>2</sup> plot and its surrounding ring plot. Quantitative comparison was used to find significant differences between burial mounds and their respective matrix. Multivariate ordination techniques were used to identify shifts in plant community structure. When compared to the surrounding matrix, stone mounds host significantly higher species richness and higher abundance and richness of grassland-specialist plant species, perennial grasses and chamaephytes, offset by lower levels of sub-nitrophilic and short-lived species. Plant communities of burial mounds were consistently different from their surrounding grassland vegetation, with differences in community composition being higher among mounds' plots than among matrix plots. Although difference was not significant, Beta-diversity was generally higher on the mounds than in their surroundings. Our results highlight the role of ancient burial mounds as grassland biodiversity refuges, while suggesting their potential capability to slow down degradation processes in grassland mosaics. Such effects, mostly associated with the stacking of local stones that possibly mimic the soil morphology of rocky calcareous grasslands, also highlight the potential of stone mounds for grassland restoration purposes.

## Poster presentation

**♣ A new aspect of seed dispersal:  
Human-dispersed diaspores can survive and disperse after the laundry  
washing**

**Katalin Lukács<sup>1,2,3</sup>, Réka Kiss<sup>1</sup>, Ágnes Tóth<sup>1,4</sup>, Balázs Deák<sup>1</sup> & Orsolya Valkó<sup>1,2</sup>**

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Due to increased human mobility, cloth-dispersed diaspores can be transported over long distances, even across continents. There are many open questions regarding the fate of human-dispersed diaspores. It is still a question how the mechanical and chemical effects to which diaspores are exposed during human-mediated dispersal, affect their germination potential and establishment prospects. We studied a potentially important component of human-vectored seed dispersal by assessing the effects of laundry washing on the dispersed seeds. We tested the germination of 18 plant species, which have already been registered as being able to spread on human clothing. We tested the effects of 21 washing treatments: seven types of detergents (water, soap nut and five types of synthetic detergents: D1- liquid laundry detergent, D2 – washing pod, D3 – washing powder, D4 – detergent with bleach and D5 – detergent with extra bleach (30%)) at three washing temperatures (30, 40 and 60 °C) compared to an untreated control (i.e. a total of 22 treatments). Our results showed that washing temperature was the most significant factor affecting germination. Gentle washing (30 °C) was neutral in case of 14 species, suppressed one species and supported three species. Washing at 40 °C had no significant effect on mean germination in case of 12 species, increased the germination in three species and decreased three species. The intense washing treatments at 60 °C significantly decreased the seedlings number in case of nine species and increased the germination capacity of nine species. The seven types of detergents had no significant effects on the germination. We showed that during human-vectored seed dispersal people are not purely transporting diaspores from one location to another, but via the laundry cycle, we can also influence the fate of the transported diaspores by affecting germination capacity. These results have new implications for understanding the early stages of biological invasions and suggests the necessity of improved biosecurity measures in protected areas facing increasing pressures from tourism.

## Oral presentation

**Forest steppes on serpentinite outcrops in Austria: a distinctive habitat or just a mosaic?****Philipp Sengl<sup>1</sup> & Martin Magnes<sup>2</sup>**<sup>1</sup>Engineering Office for Biology, Dr. Philipp Sengl, Marktstraße 21, 8354 Sankt Anna am Aigen, Austria<sup>2</sup>Department of Plant Sciences, Institute of Biology, University of Graz, Holteigasse 6, A-8010 Graz, Austria  
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**Introduction:** Habitats on serpentinite are quite conspicuous and therefore well studied in many countries and also in a broader context. The high Mg content of the soils together with the special weathering of serpentinite rocks with steep slopes have a strong selective effect on vegetation that often contains specially adapted taxa. In particular, southern facing steep slopes resemble habitats of dryer and warmer climates. In Austria there are several serpentinite outcrops; the biggest in all of Central Europe is near Kraubath in Styria, the well known “Gulsen,” which includes a surface of more than 5 km<sup>2</sup>, as well as another 18 km<sup>2</sup> east of the Mur river. From these areas, only small parts (0,7 km<sup>2</sup> respectively 0,36 km<sup>2</sup>) are protected under the Flora-Fauna-Habitat-Directive. The main reason is that only the grassland formations (*Armerio-Potentilletum arenariae*) and the vegetation on rock crevices (*Notholaeno-Sempervivetum hirti*) could be assigned to FFH habitats types (“6130” and 8220). Beside the more or less closed *Pinus sylvestris* forests on serpentinite (*Festuco eggleri Pinetum sylvestris*) on south faced slopes, we could also distinguish a more open serpentinite forest steppe.

**Methods:** We studied and mapped vegetation in the Styrian serpentinite region of the Gulsen, the Sommergraben and the Wintergraben in the upper Mur-valley near the village of Kraubath. We could distinguish a rock formation (*Notholaeno-Sempervivetum hirti*), a grassland (*Armerio-Potentilletum arenariae*) and a forest formation (*Festuco-eggleri-Pinetum sylvestris*) based on three systems of habitat classification: plant associations, habitat types of the Austrian Red List and habitat types of the Annex I of the European Habitats Directive. Additionally we collected vegetation data in forest steppe-like open formations. We conducted syntaxonomical analyses using TwinSpan-based classification and performed a detrended correspondence analysis (DCA).

**Results:** From the syntaxonomically point of view, the forest steppes do not show differential species but could be distinguish from the other formations by the lack of typical forest species, by the species indicating open habitats and especially by species that are characteristic of rock crevices.

**Conclusions:** The mainly edaphical and geomorphological determined forest steppes in the serpentinite area in Styria are an interesting habitat with a high structural diversity and should be included into the protected sites. We therefore suggest the designation and description of a new habitat type called “Serpentinite Forest Steppes” within the Red List of Habitat types of Austria.

## Oral presentation

**Spiders in the Estonian coastal grasslands during the era of Anthropocene****Mylene R. Martinez<sup>1</sup>, Kaarel Sammet<sup>1</sup> & Indrek Melts<sup>1</sup>**<sup>1</sup>Estonian University of Life Sciences, Chair of Biodiversity and Nature Tourism, Tartu, Estonia  
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Coastal habitats play a crucial role in shaping spider assemblages, with various factors influencing their abundance, diversity, and composition. The main aim of this study was to analyze the spider fauna of coastal habitats along the Baltic Sea coast in Northern Europe. We investigated 18 natural (abandoned) and 18 semi-natural (mainly grazed by cattle) coastal grasslands in the suprasaline zone within two local landscape regions: the West Estonian lowland on limestone bedrock and the Gulf of Livonia coastal lowland on sandstone bedrock. Suction sampling was used to collect ground-dwelling macroarthropods from four 50m length transects in each grassland. Five suction samples were taken in each transect and pooled as one sample. Two sampling rounds were carried out in June and August 2022. The spiders collected were sorted into juveniles and adults, with adult spiders identified at the species level. A total of 8,069 specimens (6,824 juveniles and 1,245 adults) were counted, and 157 species from 21 families were identified. Among the highlights of this study was the discovery of eight spider species previously unrecorded in Estonia: *Agroeca dentigera* (Kulczyński, 1913), *Pardosa maisa* (Hippa & Mannila, 1982), *Theridosoma gemmosum* (L.Koch, 1877), *Rugathodes instabilis* (Pickard-Cambridge, 1871), *Donacochara speciosa* (Thorell, 1875), *Mermessus trilobatus* (Emerton, 1882), *Pocadicnemis juncea* (Locket & Millidge, 1953) and *Walckenaeria alticeps* (Denis, 1952). In addition to the discovery of new species in different coastal grasslands, we found that land use, transects, and landscape region were important factors for spider abundance in general. The total abundance was highest in grassland margins and abandoned grasslands, primarily driven by high juvenile counts. No significant factors were found for adult abundance, but for juveniles, all factors and their interactions were significant. Overall, the highest number of individuals, both adults and juveniles, were found in abandoned grasslands and the Gulf of Livonian Coastal Lowland. Species richness and diversity were influenced by both landscape region and land use. The highest species richness and diversity were observed in abandoned grasslands and the Gulf of Livonian coastal lowland. These new records may indicate range shifts likely due to changing climatic conditions. The high counts of juveniles contribute to the establishment of second generations, which is beneficial for biodiversity. The results also emphasize the importance of habitat heterogeneity and varying management schemes for spiders at a landscape level. Furthermore, understanding the factors that influence spider assemblages in coastal grasslands is crucial for developing effective conservation and management strategies. Investigating the interactions between spiders and landscape regions, human disturbances, edge effects, vegetation structure, habitat heterogeneity, and other factors can provide valuable insights into the ecology of spiders in coastal ecosystems.

## Poster presentation

**Biomass-species richness relationship along an elevation stress gradient at an alkaline-loess habitat complex**

**Andrea McIntosh-Buday<sup>1,2</sup>, Katalin Tóth<sup>2</sup>, Judit Sonkoly<sup>1,2</sup>, Viktória Törő-Szijgyártó<sup>1</sup>, Patricia Elizabeth Díaz Cando<sup>1</sup>, Gergely Kovacsics-Vári<sup>1</sup>, Béla Tóthmérész<sup>1,3</sup> & Péter Török<sup>1,2</sup>**

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Studies focusing on the relationship between biomass and species richness with a fine-scale sampling are essential for understanding vegetation dynamics in grasslands. This information also helps to fine-tune sustainable ways of grassland management. We aimed to study biomass-species richness relationship using fine-scale biomass sampling in various loess and alkaline grassland communities in the Hortobágy Puszta, Great Hungarian Plain, Hungary. Three sites with typical zonation of loess-alkaline vegetation were selected for the sampling. Line transects (30-50m long, depending on the site) were placed along a gradient of elevation, humidity, and stress, following the sequence from *Salvio-Festucetum* loess grasslands at the highest points to the *Alopecuretum* meadows at the lowest points. The total above-ground biomass in 20cm × 20cm plots was harvested at 1m intervals along the transects at the beginning of June, when biomass production peaked. Biomass samples were sorted into green biomass and litter fractions after drying. The green biomass was sorted into species. All species were classified into one of the mixed C-S-R strategy types. The highest biomass of competitor (C) species was in the *Alopecuretum* meadows, while the ruderals (R) were the most abundant in the loess grasslands. We found the highest proportions of stress-tolerators (S) in biomass at intermediate positioned plots, in alkaline short grasslands. Our results suggest that even at fine-scale stress gradients complex interactions between species with different ecological strategies fine-tune species richness-biomass relationship in grasslands.



## Oral presentation

**“Blooming Meadows”: Implementation of Result Based Conservation Scheme in Latvia****Maija Medne<sup>1</sup> & Girts Baranovskis<sup>2</sup>**<sup>1</sup>Nature Conservation Agency of Latvia; Daugavpils University<sup>2</sup>Nature Conservation Agency of Latvia; University of Latvia[maija.medne@daba.gov.lv](mailto:maija.medne@daba.gov.lv)

Semi-natural grasslands (habitats of EU importance) cover less than 1% of Latvia's territory and their area and quality continues to decrease. In order to ensure a favourable conservation status of grassland habitats it is essential not only to preserve the existing natural meadows and pastures, but to increase quality of potentially biologically valuable grasslands as well. In 2021-2022 within *LIFE-IP LatViaNature* project we designed a pilot-programme “Blooming Meadows” (BM) for potentially biologically valuable grassland conservation in Latvia. In cooperation with nature conservation and agriculture experts, universities, non-governmental organizations and other institutions we developed the framework for BM. To begin we conducted a survey (n = 442) in order to explore private grassland owners' and managers opinion, abilities and motivation to take part in grassland conservation activities. The survey included questions regarding the maintenance of perennial grasslands, management preferences, the necessary types of support, and other. Simultaneously we collected information regarding different grassland conservation programmes across the Europe (e.g. Ireland, UK, Romania, Slovenia, Germany, Estonia, Lithuania), focusing on the following aspects: target areas (environmental tasks), structure of the programme, cooperation with grassland owners; financial aspects, monitoring, programme administration and others. Analyzing grassland owners' needs, best practices of other European countries and challenges of Latvian grassland conservation we designed the result-based grassland conservation pilot-programme for Latvia. As a result, BM was developed. In 2022 we published call for participants and received four time more applications as we expected. In 2023 we entered into contracts with 70 grassland owners and managers, providing adaptive management for 675 ha of potentially biologically valuable grasslands. A duration of contracts is four years (2023.-2027.). Participants of BM receive grassland conservation expert consultations and financial support that depends on success of grassland conservation (result-based and hybrid approach). Every participant is involved in the monitoring of grassland biodiversity that includes assessment of grassland structure and the presence of plant species (50) typical for semi-natural grasslands. First observations of programme implementation highlight the importance of proper communication capacity, reasonable monitoring planning and reveal grassland owners' great willingness to learn about grassland conservation including getting to know new plant species.

## Oral presentation

**♣ Enhancing habitat occupancy of the endangered Hungarian meadow viper (*Vipera ursinii rakosiensis*) through restoration of plant diversity of secondary grasslands on abandoned ploughfields**

**Edvárd Mizsei<sup>1,2,3</sup>, Mátyás Budai<sup>4</sup>, Wenner Bálint<sup>5</sup>, Gergő Rák<sup>4</sup>, Dávid Radovics<sup>2,3</sup>, Barnabás Bancsik<sup>5</sup>, Gergő Kovács<sup>6</sup>, Ádám Tisza<sup>4</sup>, János Simics<sup>7</sup>, Márton Szabolcs<sup>3</sup>, Csaba Vadász<sup>1</sup> & Attila Móré<sup>1,2</sup>**

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Grasslands, as one of the most species-rich and endangered ecosystems globally, face a significant decline in their coverage, leading to the endangerment of species adapted to these habitats, such as the Hungarian meadow viper (*Vipera ursinii rakosiensis*). The species richness of grasslands plays a crucial role in their stability, resistance, and resilience against disturbances and environmental changes. In recent decades, abandoned arable fields, particularly those unsuitable for crop production due to inadequate edaphic and climatic conditions, have been converted into grasslands, which become low-quality secondary grasslands after abandonment or restoration. We employed floral diversification by sowing native plant seeds from over 50 species characteristic of primary viper habitats, covering an area of more than 100 hectares. To assess the impact of grassland restoration on the habitat occupancy of the Hungarian meadow viper, we employed a Before-After/Control-Intervention (BACI) experimental design. A stratified random sampling design was utilized, consisting of 10 control plots (abandoned cropland without restoration) and 12 intervention plots (abandoned cropland with restoration), each measuring 50×50 meters. Viper observations were recorded during ten surveys conducted in the spring and autumn seasons of 2020-2023. The occupancy model, fitted to the Hungarian meadow viper observation data, revealed an increase in occupancy rates at diversified sites. Moreover, the colonization probability showed a significant increase, while the extinction probability significantly decreased compared to the control sites. Furthermore, at a larger spatial scale, we discovered individual vipers in two of the restored grasslands where no previous data supported their presence. This study demonstrates the positive impact of diversifying secondary grasslands on the population of *V. u. rakosiensis* and the floral diversity of regenerating Pannonic sand grasslands. These findings highlight the importance of restoration efforts and the role of diversification in enhancing habitat occupancy and conservation of threatened species in grassland ecosystems.

**Oral presentation****Could hundreds of species have disappeared from loess grasslands as they were ploughed up? Undocumented loss and extinction debt in the Hungarian Great Plain****Attila Molnár<sup>1</sup> & Béla Tóthmérész<sup>2</sup>**<sup>1</sup>MTA-DE Biodiversity and Ecosystem Services Research Group, Debrecen, Hungary<sup>2</sup>Department of Ecology, Faculty of Science and Technology, University of Debrecen, Debrecen, Hungary[molnar.att0320@gmail.com](mailto:molnar.att0320@gmail.com)

The Hungarian Great Plain is an agricultural landscape. Here we compared the documented extinct species list of the vascular flora of two areas, on the eastern and western banks of the Tisza River, the main tributary of the Danube. We classified this list into the following habitat categories: loess grasslands, forests, wetlands, sandy grasslands and woodlands and halophytic communities. We did not assess anthropogenic habitats because, unlike natural flora, they generally do not show any loss of area. We used species-area relationship models to estimate the potential extent of the undocumented extinction of this region based on the quantifiable habitat losses (e.g. First /1782-1785/ and Second /1819-1869/ Military Survey of Hungary etc.) and the documented extinction. For natural habitats, their loss of cover is estimated to be around 90%, but for loess grasslands, the loss was around 98-99% in the Great Plain. Based on a species-area relationship model, if 90% of the original habitat was destroyed, the species loss would be around 30% and for loess grassland habitats 47-52%. This means that there must once have been many more species living there than the number of living and extinct species currently known (although in fact only ca. 20-30 loess species are known to have become extinct). We argue that two factors may underlie the overestimation of extinction based on area loss: (1) extinction debt, (2) undocumented extinction that took place before botanical research began. To refine the overestimating calculation, we introduced a correction factor ( $C$ ) as a multiplier (and  $C \leq 1$ ) based on the extinction debt. The  $C$  value is based on documented extinction in wetlands where, unlike in loess grasslands, floristic surveys started well before large-scale water management activities, hence we expect undocumented extinction to be small, hence, low number of extinct species must be the sign of extinction debt. We conclude that the extent of undocumented extinction on loess grasslands could not have been significant, certainly not a magnitude different from the documented extinction (we estimate 15-50 undocumented extinct species). It can be ruled out that there were hundreds of unknown disappeared species, possibly many that are missing today from Hungary or the whole Carpathian Basin. In addition to the calculated undocumented extinction, still there is a big ratio of extinction debt for loess grasslands.

**Oral presentation****♣ The Flora Continuity Hypothesis: massive potential survival of the flora since before the Last Glacial Maximum in the Carpatho-Pannonian region****Ábel Péter Molnár<sup>1</sup>, László Demeter<sup>2</sup>, Marianna Biró<sup>2</sup>, Milan Chytrý<sup>3</sup>, Sándor Bartha<sup>2</sup>, Gantuya Batdelger<sup>4,5</sup> & Zsolt Molnár<sup>2</sup>**<sup>1</sup>Hungarian University of Agriculture and Life Sciences, Doctoral School of Biological Sciences, Gödöllő, Hungary<sup>2</sup>Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary<sup>3</sup>Masaryk University, Brno, Czech Republic<sup>4</sup>Botanic Garden and Research Institute, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia<sup>5</sup>Eötvös Lorand University, Doctoral School of Biology, Budapest, Hungary[molnarabel@gmail.com](mailto:molnarabel@gmail.com)

The dominant paradigm about the Quaternary history of Central European ecosystems is that they were repeatedly impoverished by regional extinctions of most species during the glacial periods, followed by massive recolonizations from southern and eastern refugia during interglacial periods. Recent scientific advances partially contradict this view and provides evidence to re-evaluate the Postglacial Recolonization Hypothesis and develop an alternative one. We examined the long-term history of the flora of the Carpathian (Pannonian) Basin by synthesizing recent advances in ecological, phylogeographic, paleoecological and paleoclimatological research, and preparing an analysis of the cold tolerance of the native flora of a test area (Hungary, the central part of the Carpathian Basin). We found that many species have likely been continuously present since before the Last Glacial Maximum (LGM) period, most of the present-day native flora (ca. 80%) can occur under climates as cold as or colder than the LGM ( $\leq +3.5^{\circ}\text{C}$  MAT), and habitats (grasslands and forests) can be species-rich under an LGM-like cold climate. These arguments support our new Flora Continuity Hypothesis, which states that long-term and massive flora continuity is more plausible than LGM extinction followed by massive postglacial recolonization in the Carpathian Basin. The long-term continuity of regional floras may have fundamental implications not only for biogeographical and ecological understanding (e.g. temporal scale of ecological processes), but also for developing conservation strategies (e.g. increased need to protect ancient species-rich ecosystems and local gene pools).

## Oral presentation

**♣ Plant diversity patterns in an endangered semi-open forest in central Poland – the example of Krzemionki Nature Reserve****Lara Moloniewicz<sup>1</sup> & Szymon Czyżewski<sup>2</sup>**<sup>1</sup>Independent researcher<sup>2</sup> Centre for Ecological Dynamics in a Novel Biosphere (ECONOVO) & Center for Biodiversity Dynamics in a Changing World (BIOCHANGE), Department of Biology, Aarhus University, Ny Munkegade 114, DK-8000 Aarhus C, Denmark[lara.moloniewicz@gmail.com](mailto:lara.moloniewicz@gmail.com)

Semi-open, thermophilous oak forests (*Potentillo albae-Quercetum*) are habitats that harbour great plants diversity, with species characteristic for dry grasslands, seasonally wet meadows, forest ecotones, as well as species inhabiting only this habitat. In Poland, they are in decline because of the land-use changes, the lack of big herbivores and the recession of extensive farming. Thus, in order to be able to plan appropriate conservation measures and stop the biodiversity loss, it is important to study well-preserved fragments of thermophilous oak forests. One of the best preserved fragments of *Potentillo albae-Quercetum* in Poland can be found in Krzemionki nature reserve. The reserve was established to protect an area of neolithic flint mines. There we have performed detailed botanical inventory focused mostly on the flint exploitation field (ca. 40 ha). The inventory included 32 relevés of 100m<sup>2</sup> each and detailed distribution maps for all of the endangered species. We have found 367 vascular plant species (24 of which endangered) and 36 moss species. The maximum number of vascular plant species per relevé was 98. The flora of the reserve includes rarities such as *Adenophora liliifolia*, *Daphne cneorum*, *Festuca amethystina* or *Cypripedium calceolus*. Not only the number of species, but also the population sizes were very high for some of the endangered species. To investigate which environmental factors may be related to such big biodiversity, we performed statistical analysis fitting linear mixed-effects models with current and past habitat openness as well as shrub removal (performed in 2017-2019) as explanatory variables. The biodiversity measured as species richness was higher in more open places ( $p=0.001$ ) and where shrub removal was performed ( $p<0.001$ ). The biodiversity measured with Shannon evenness index was also higher in places with shrub removal, but the effect was mediated by current canopy openness ( $p=0.011$ ). Our results indicate that shrub removal is an effective active protection measure, but its effect may be influenced by other environmental factors. In general, the openness of the forest seems to be the key factor influencing biodiversity. Also, we discuss the potential influence of archaeological works, neolithic mining activity and other anthropogenic factors on the reserve's flora.

## Poster presentation

**Decreasing provenance differentiation in the second generation of *Festuca vaginata* supports flexible seed sourcing for restoration in Hungary****Meso Odongo<sup>1</sup>, Anna Mária Csergő<sup>2</sup> & Katalin Török<sup>3</sup>**<sup>1</sup>Hungarian University of Agriculture and Life Sciences, Institute of Horticulture, Budapest, Hungary<sup>2</sup>Hungarian University of Agriculture and Life Sciences, Budai Campus, Department of Botany, Budapest, Hungary,<sup>3</sup>Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary,  
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Ecological restoration is frequently applying native seeds to counteract degradation or re-establish grasslands. Species adaptation to local environment justifies the need to regulate seed provenance that is, in the lack of species-specific genetic knowledge, usually guided by Seed Transfer Zones (STZ). These are geographically distinct areas within which seeds of target species can be introduced without a high risk of maladaptation and reduced risk of loss of biodiversity. As STZs are usually developed based on biogeographical and vegetation regions, testing the zones for particular species has relevance. Comparing fitness traits among populations from different zones in common gardens is the usual method for testing STZs. We have previously investigated population traits of plants grown under homogenous conditions from seeds collected directly from the field. In this study we used the seeds produced by these plants to grow the second generation in order to test whether the provenance differentiation, detected in the first generation among sites remained in the second generation. This has relevance in ecological restoration as maternal effect can also give rise to trait differences, however, this will fade in further generations and must not be taken into consideration in seed provenancing. For this experiment we used *Festuca vaginata* as test species. Altogether 116 samples from 19 locations and 4 STZs were planted in a common garden at Vácrátót in September 2022. Each pot was planted with 15 seeds, harvested from the same mother plant of the first generation. Seedlings, except one per plot (to later measure adult traits) were harvested in June 2023. In parallel, seeds from 16 locations were germinated in a growth chamber cumulative numbers were used for the analyses. We measured the following traits: germination success in chamber, emergence in the pots, above ground dry biomass of seedling, length of the longest leaf of seedlings. We fitted Generalized Linear Mixed Models (GLMM) to analyze the effect of the STZ on measured traits and we analyzed pairwise differences in mean trait values between STZs with Tukey's HSD post hoc tests. We used one-way ANOVA tests to decompose the trait variation within and between different STZs. The GLMMs found no significant effect of the STZ on the measured traits, and Tukey's HSD tests showed no significant differences in mean trait values between STZs. The ANOVA test indicated significantly higher variation of the seed germination success and leaf length between sampling locations within STZs than between STZs. In comparison to the first generation, where all seed traits and emergence success showed significant local differentiation, these results suggest that there is an important maternal effect that faded in the second generation. We conclude that there is no need to restrict seed sourcing to within STZs when using *F. vaginata* for species introduction in restoration projects.



## Poster presentation

**A call to join the study of *Salvia nemorosa* L. demography on kurgans.****Santiago Ordonez Jacome<sup>1</sup>, Balázs Deák<sup>2</sup>, Orsolya Valkó<sup>2</sup>, Vivien Szász<sup>1</sup>, Krisztina Verbényiné Neumann<sup>3</sup>, Nour Elhaida Zayani<sup>4</sup> & Anna Mária Csergő<sup>5</sup>**<sup>1</sup>Hungarian University of Agriculture and Life Sciences, Institute of Horticulture, Budapest, Hungary<sup>2</sup>'Lendület' Seed Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research, Vácrátót, Hungary<sup>3</sup>Hungarian University of Agriculture and Life Sciences, Department of Nature Conservation & Landscape Management, Gödöllő, Hungary<sup>4</sup>Eötvös Loránd University, Faculty of Science, Budapest, Hungary<sup>5</sup>Hungarian University of Agriculture and Life Sciences, Department of Botany, Budapest, Hungary  
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Land use changes such as the shift to intensive agriculture have dramatically reduced the amount and connectivity of dry grasslands. In these transformed landscapes dry grassland specialist species have often persisted in small habitat fragments, such as kurgans, ancient burial mounds of Eurasia. Community-level responses to increasing isolation and small habitat area suggest unpaid extinction debt of grassland specialist plants on kurgans of Hungary. The exact causes of extinction and mechanisms of long-term population persistence can be detected through detailed demographic studies repeated over time, which are largely lacking for grassland specialist species in these habitat fragments. Our study focuses on the demographic mechanisms of persistence in a model species, *Salvia nemorosa* L. on kurgans. Kurgans were chosen as a model system due to 1) having different sizes and different degrees of isolation, 2) having high microhabitat heterogeneity, and 3) being protected by law in Hungary since 1997, which prevents the risk of anthropogenic intervention and modification of the vegetation structure. *S. nemorosa* was selected as model species based on 1) being a dry grassland specialist typical of loess-grasslands, 2) having surviving populations of varying sizes on different kurgans and under different microhabitat conditions within a kurgan, 3) having a relatively simple life cycle, and 4) being easily identified, tagged, and measured. We have been collecting data over three consecutive years, between 2021-2023 on 12 kurgans and two reference flat sites in the Great Hungarian Plain. The study was performed from early June to early July, at the peak flowering time of *S. nemorosa*. We recorded site (e.g., Hanski isolation index, kurgan area), and transect-level environmental variables (e.g., aspect, slope angle, temperature, humidity), as well as plot-level community and environmental variables (e.g., vegetation cover, *S. nemorosa* cover). We permanently marked between 30-100 individual plants per population with a numbered linoleum tag, and followed the demographic fates (survival, growth, reproduction) of all individuals, as well as new individuals (recruitment) each year. Preliminary results suggest that local habitat conditions (e.g., heat load), has a much stronger effect on the traits of *S. nemorosa* (e.g., stem height, number of stems and mean leaf area) compared to the landscape structure measures isolation and kurgan area. Therefore, intense heat and associated drought put an important toll on plants that rely on small habitat fragments for their survival. Expanding these observations beyond our study area would enable more robust tests of the land use effects on *S. nemorosa* populations across different macroclimates. This is a call to join the study and contribute data on single or multiple populations of *S. nemorosa* from kurgans across the species' whole geographic area of distribution.



## Poster presentation

**Communities with high abundance of the Balkan subendemic *Satureja pilosa* in Bulgaria****Kalina Pachedjieva<sup>1</sup>, Georgi Kunev<sup>2</sup> & Gabriela Petrova<sup>2</sup>**

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*Satureja pilosa* Velen. (Lamiaceae) is an aromatic plant species distributed mainly in the SE Balkans (Bulgaria and N Greece) and in two disjunctions - N Italy and W Anatolia. In Bulgaria it is most abundant in the Central Balkan Mts. and the Central and Eastern Rhodopes. *Satureja pilosa* is rich in essential oils potentially useful in certain human health conditions and has been an object of investigations mainly on the composition of volatile compounds and their medicinal properties. As a low subshrub (chamaephyte) with prostrate habitus, it plays an important role in preventing soil erosion. However, not much is known about the species composition and habitat conditions of the communities in which it participates, neither on their classification. The present study is focused on the floristic composition, structure, and ecology of the communities with high abundance of *Satureja pilosa* found in Bulgaria. In total 50 plots have been sampled during the vegetation seasons of 2020-2022 and analyzed according to the Braun-Blanquet’s phytocoenological approach. The numerical analysis resulted in the distinction of two heterogeneous groups of relevés which are geographically and floristically well defined. They are found respectively in the Balkan Mts. and the Rhodopes. Their composition has been formed under strong Mediterranean influence more evident in the Rhodopes. The rock types, slope inclination and exposition are various. The vegetation density is relatively low, and the distribution patterns of the plants are mosaic. More than 400 species and subspecies of vascular plants take part in these communities, most of which cover about 1-5% of the examined sites. *Satureja pilosa* and some other participants in its habitat, mainly from the families *Lamiaceae* and *Fabaceae*, are preferred hosts for the stem holoparasites *Cuscuta epithimum* and *C. approximata*. Syntaxonomically the differentiated groups represent new plant associations which most probably belong to the order *Stipo pulcherrimae-Festucetalia pallentis* of the class *Festuco-Brometea*. However, their affiliation to the alliance *Saturejon montanae* which comprises species-rich grasslands on calcareous substrates stays arguable.

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## Poster presentation

**Impact of mowing abandonment and grazing on very species-rich meadow steppes in Transylvania (Romania)****Inge Paulini<sup>1,2</sup>, Inge-Beatrice Biro<sup>2</sup>, Monica Beldean<sup>3</sup>, Gwyn Jones<sup>4</sup> & Wolfgang Schumacher<sup>1</sup>**<sup>1</sup>Institute of Crop Science and Resource Conservation (INRES), University of Bonn, Germany<sup>2</sup>Asociația Mozaic, Cluj-Napoca, Romania<sup>3</sup>Asociația Pentru Natură și Oameni, Cojocna, Romania<sup>4</sup>European Forum on Nature Conservation and Pastoralism (EFNCP), Lampeter, United Kingdom[i.paulini@posteo.de](mailto:i.paulini@posteo.de)

In the peri-Carpathian region some basiphilous semi-dry grasslands of the alliance *Cirsio-Brachypodium pinnati*, also called meadow steppes, feature exceptionally high values of vascular plant richness, especially when managed as traditional hay meadows over long periods. However, due to the socio-economic transformation processes of agriculture in the post-communist era, traditional meadows are increasingly exposed to land use changes. This study aims to determine how the plant diversity, vegetation structure, and floristic composition of species-rich meadow steppes change as a result of mowing abandonment or transformation into sheep pastures. The surveyed hay meadows are situated in the Hills of Cluj in the north-western part of the Transylvanian Plateau (Romania). Nested-plot multi-scale phytodiversity relevés were carried out in the years 2012 and 2013 in mown, unmown, and grazed *Cirsio-Brachypodium pinnati* stands. Mowing abandonment for several years resulted in a decrease of vascular plant species richness and a shift in species composition within the typical species inventory of the original plant community. Conversion of the traditional meadows to permanent sheep pastures led to a decrease in vascular plant species richness and evenness and a replacement of typical meadow species through species of other communities, including ruderal vegetation. Furthermore, one of the worldwide highest known values of small-scale vascular plant species richness could be found in a regularly mown *Cirsio-Brachypodium pinnati* stand (26 species on 0.01 m<sup>2</sup>). The results show the high importance of regular mowing for maintaining the plant diversity and typical species composition of the extremely species-rich meadow steppes in traditional hay meadows in Transylvania.

## Poster presentation

**♣ Physiological responses of *Artemisia diffusa* to different grazing intensities in rangelands of Uzbekistan****Abdubakir Kushbokov<sup>1,2,3</sup> & Nodirjon Bobokandov<sup>3</sup>**<sup>1</sup>Lendület' Seed Ecology Research Group, Institute for Ecology and Botany, Centre for Ecological Research, Vácrátót, Hungary<sup>2</sup>University of Szeged, Szeged, Hungary<sup>3</sup>Samarkand State University, Samarkand, Uzbekistan[gabdubakir@mail.ru](mailto:gabdubakir@mail.ru)

Biodiversity conservation of rangeland ecosystems is an essential task since rangelands face several degradation conditions in Uzbekistan and worldwide. Grazing is an important land use, particularly in Uzbekistan's arid zones, which occupy roughly 78% of total rangeland areas. In addition, several anthropogenic and environmental factors, such as the overutilisation of land resources, climate change, and overgrazing are the main drivers of the rangeland ecosystem collapse in Uzbekistan. Unsustainable grazing throughout the whole year around settlement areas has caused severe trampling and overgrazing, leading to rangeland degradation and biodiversity loss. The current research investigated the changes in pigment content concentration (chlorophyll a and b, carotenoids) of *Artemisia diffusa* and its physiological response under different grazing intensities in different seasons (spring and autumn) moving away from wells in *Artemisia*-dominated desert rangelands. The study was conducted in the southern part of Kyzylkum which administratively belonged to the Zafarabad district of Navai province. Two study sites were selected for investigations which were degraded and non-degraded areas. The study sites were selected by moving away from focal points (watering wells) along a grazing intensity gradient from the sacrificed zone (overgrazed areas near wells) to 1000 m (light grazed areas). The pigment extracts and their absorption spectra were measured in pure organic solvents using a modern spectrometer, which allowed us to re-determine their specific absorption coefficients. They are for chlorophyll a-662 nm, b-644 nm, and carotenoids-470 nm. Preliminary results depicted that the photosynthetic pigment content of *Artemisia diffusa* was significantly higher in the sacrificed zone and showed a downward trend by moving away to light grazing gradients in both study sites and seasons. The amount of chl a, chl b and Cars of *A. diffusa* around watering wells (heavily grazed, 0 to 300 m) was 1.8 mg/L, 1.2 mg/L, and 2.4 mg/L respectively in the spring season. In comparison, the pigment concentration far from watering wells (light grazed, 800 to 1000 m) was 1.4 mg/L, 0.9 mg/L, and 1.6 mg/L. Whereas the amount of pigment concentration in the autumn season around watering wells was 1.2mg/L, 0.9 mg/L, and 1.8 mg/L while in the far distance, the concentration of pigments was 0.8 mg/L, 0.6 mg/L, and 0.7 mg/L respectively. Obtained results suggested that the pigment content of native *Artemisia diffusa* was higher in heavily grazed gradients compared to lightly grazed gradients. These obtained results indicate that *A. diffusa* has a greater growing tendency and higher photosynthetic capacity under increased grazing pressure. In addition, increased levels of livestock grazing intensified the process of production of pigments for tested rangeland plants. To sum up, these kinds of physiological features of dominated plants in rangelands might be an indication of the restoration capacity of degraded rangelands and further studies will be demanded to understand the physiological responses of plants to various environmental factors in Uzbekistan.

## Poster presentation

**Study of the peculiarities of the bryophyte cover of the dry meadows of south-eastern Alps****Iryna Rabyk<sup>1</sup>, Christian Dolnik<sup>2</sup> & Maria Yuskovets<sup>1</sup>**<sup>1</sup>Institute of ecology of the Carpathians NAS of Ukraine, Lviv, Ukraine  
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The geographical position and orientation of the slopes of the dry valleys of the southeastern Alps determine the unique natural conditions of these territories: a small average annual amount of precipitation in combination with high solar insolation causes the development of thermophilic flora. Many typical species of steppe meadows of Central and Eastern Europe and endemic species are found here. Therefore, it is also important to study the diversity of mosses and liverworts of dry valleys. The bryophyte samples were collected together with a group of researchers in the context of the 17th EDGG field workshop. We analyzed the material from the moderately dry valleys of the Eisack/Isarco and Adige/Etsch valley, to the Valtellina, Val di Sole and Valcamonica, and the most extreme dry valley system of the Eastern Alps: the Vinschgau/Venosta valley and Val Müstair in Switzerland. As a result of studies, standardized data on bryophytes biodiversity were collected together with structural data. The modest contribution of the authors concerns only information about the biodiversity of certain groups of bryophytes of the dry meadows of South Tyrol, their ecological and biomorphological characteristics, peculiarities of sexual and vegetative reproduction. On the research territory widely represented such species as *Abietinella abietina* (Hedw.) M. Fleisch., *Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr, *Rhytidium rugosum* (Hedw.) Kindb., *Bryum argenteum* Hedw., *Thuidium delicatulum* (Hedw.) Schimp., *Polytrichum piliferum* Hedw., *Polytrichum juniperinum* Hedw., *Niphotrichum canescens* (Hedw.) Bedn.-Ochyra & Ochyra, *Hypnum cupressiforme* Hedw., *Ptychostomum capillare* (Hedw.) Holyoak & N. Pedersen, *Ptychostomum elegans* (Nees) D. Bell & Holyoak, *Ptychostomum imbricatum* (Müll. Hal.) Holyoak & N. Pedersen, *Ptychostomum moravicum* (Podp.) Ros & Mazimpaka, *Bryum radiculosum* Brid., *Bryum dichotomum* Hedw., *Weissia brachycarpa* (Nees & Hornsch.) Jur., *Weissia controversa* Hedw., *Barbula unguiculata* Hedw., *Campylopus pilifer* Brid., *Tortula acaulon* (With.) R.H. Zander, *Syntrichia montana* Nees, *Syntrichia laevipila* Brid., *Fissidens dubius* P. Beauv. Mosses that grow on stones: *Schistidium apocarpum* (Hedw.) Bruch & Schimp., *Hedwigia ciliata* (Hedw.) P. Beauv., *Grimmia pulvinata* (Hedw.) Sm., *Grimmia incurva* Schwägr., *Homalothecium lutescens* (Hedw.) H. Rob. Among the liverworts can be noted: *Cephaloziella divaricata* (Sm.) Schiffn., *Cephaloziella rubella* (Nees) Warnst. *Riccia ciliifera* Link, *Riccia sorocarpa* Bisch, *Mannia fragrans* (Balb.) Frye & L. Clark, *Targionia hypophylla* L. Sexual types of bryophytes and the presence of specialized organs of asexual reproduction have been determined. According to the humidity of the locations, the ecological group of xerophytes prevails, but a significant share of mesophytes was found. The dominant life forms of bryophytes are short turfs, wefts, cushions and mats.

## Poster presentation

**♣ Effects of Grazing Pressure and Phytomass Productivity on the Density of the Hungarian Meadow Viper (*Vipera ursinii rakosiensis*) in Kiskunság**

**Gergő Rák<sup>1</sup>, Mátyás Budai<sup>1</sup>, Bálint Wenner<sup>1</sup>, Barnabás Bancsik<sup>2</sup>, Ádám Tisza<sup>1</sup>, Attila Móré<sup>3</sup>, Gergő Kovács<sup>4</sup>, Dávid Radovics<sup>5</sup>, Márton Szabolcs<sup>5</sup>, Zoltán Korsós<sup>2</sup> & Edvárd Mizsei<sup>3</sup>**

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In the case of endangered species, conservation efforts must prioritize the preservation and improvement of their remaining habitats. The Hungarian meadow viper (*Vipera ursinii rakosiensis*), a strictly protected species, has lost a significant portion of its habitats, and the few remaining ones are being exploited for economic reasons. As a result, the species has been pushed to the brink of extinction, prompting special attention from conservationists. Based on existing experience and research findings, grazing has emerged as the sole positive grassland management approach for this species. Given the multifaceted nature of grazing as a grassland usage, it was essential to conduct a detailed study on how grazing pressure affects the density of the Hungarian meadow viper, taking into account the productivity of pastures with different grassland vegetation communities. The objective of this research was to provide a comprehensive examination of grazing to support evidence-based conservation efforts for this endangered viper. We conducted repeated measurements in 78 plots measuring 50 × 50 meters over a period of four years, with two surveys per year in spring and autumn, and a minimum of ten surveys per plot per season. Information necessary for calculating grazing pressure (animal units per hectare) was obtained from local farmers. Additionally, we estimated grazing pressure using dung density, and the phytomass production of characteristic vegetation communities in the pastures was also measured. These variables were incorporated into an N-mixture model, where the number of viper observations during the repeated surveys served as the dependent variable. The explanatory variables for detectability were operative temperature, while grazing pressure (both calculated and estimated) and total productivity served as explanatory variables for density. Our findings revealed a significant negative effect of estimated grazing pressure on density, as well as phytomass productivity. According to the results, the Hungarian meadow viper exhibits sensitivity to grazing pressure and prefers grassland vegetation communities with lower productivity. By reducing grazing pressure, more favourable conditions can be created for the viper. However, given the non-uniform distribution of grazing pressure across different micro-habitats and the reduced expertise of modern-day shepherds compared to the past, the implementation of our results must be approached with caution. Nevertheless, future studies should continue to explore the effects of regulated grazing, as described above, while examining grazing pressure within specific vegetation community types.

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**Oral presentation****Restoration of dry and sandy habitats in  
Brandenburg, Germany by LIFE****Janine Ruffer<sup>1</sup>, Holger Rößling<sup>1</sup>, Daniel Lauterbach<sup>2</sup>, Stefanie Luka<sup>1</sup> & Sophie Desaga<sup>1</sup>**<sup>1</sup>Stiftung NaturSchutzFonds Brandenburg, Potsdam, Germany<sup>2</sup>Botanical Garden of the University of Potsdam, Germany[janine.ruffer@naturschutzfonds.de](mailto:janine.ruffer@naturschutzfonds.de)

A huge variety of open dry sandy habitats has been frequently found in Brandenburg, the area around Berlin between the rivers Elbe and Oder for quite a long time. But mainly due to changes in land use, these characteristic landscapes are about to disappear. With the LIFE Sandrasen project, the foundation “Stiftung NaturSchutzFonds Brandenburg” has supported the protection of sandy habitats in several Natura 2000 areas from 2013 to 2019 in the area ‘Dahme-Seengebiet’ southeast of Berlin. The project was set up to stop the rapid loss of xeric sandy calcareous grasslands (HT \*6120) and dune and heathland habitats (HT 2310, 2330, 4030). From the second half of 20th century, these open habitats have been virtually vanished due to intensification and abandonment of land use and afforestation. According to results of ex-ante monitoring habitat type \*6120 was shrunk to small and often isolated occurrences of habitats and plant communities in Natura2000-sites of the project region. This loss of habitat type \*6120 was mainly connected to acidification, loss of open sandy habitats and reduction or even extinction of plant populations characteristic for habitat type \*6120. Due to this situation, the LIFE Sandrasen not only addressed classical conservation actions such as shrub removal and implementation of regular grazing on the project sites. It focused additionally on creating new open sand habitats and reintroducing typical, often threatened plant species. The presentation will highlight the main results and lessons learned from LIFE Sandrasen. Furthermore, it will give first results on the LIFE Trockenrasen project, which focuses on calcareous and steppic dry grasslands (HT \*6240) in Brandenburg from 2019 to 2026.



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**Oral presentation****Plant species response at the interface of crop fields to protected grasslands  
– impact of farm practices****Benito Schöpke<sup>1,2</sup>, Karsten Wesche<sup>3,4,5</sup> & Monika Wulf<sup>1,2</sup>**<sup>1</sup>Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany<sup>2</sup>Institute of Biochemistry and Biology, University of Potsdam, Potsdam, Germany<sup>3</sup>Botany Department, Senckenberg Museum of Natural History Görlitz, Görlitz, Germany<sup>4</sup>International Institute Zittau, Technische Universität Dresden, Zittau, Germany<sup>5</sup>German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany  
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There is an urgent need to stop the loss of biodiversity and associated ecosystem functions in our agricultural landscapes. The structural heterogeneity of these landscapes is elementarily made up by edges, many of them between habitats of different quality in the sense of biodiversity. If we want to find the most effective conservation measures, we need to understand how common habitats and their land use influence each other. The interface of grasslands and crop fields is so far not much studied, particularly at fine scale, although it is a widespread boundary in Central Europe. Here, we sampled the vegetation continuously on transects from the interior of organically and conventionally farmed arable fields far into adjacent protected semi-natural grasslands in two German landscapes. We found that grasslands adjacent to organic fields had a higher plant diversity - even far into their interior. We could show that the decreasing richness towards the grassland edges continued transitionally into the crop fields, as predicted by theory, and that this response is driven by specialists as well as generalists. Beyond that, and due to the occurrence of additional edge species, the transitional zones at the grassland – crop field interface increased the landscapes gamma diversity. We observed ecological indicator values, particularly for nutrients, to be associated with the species response curves over the transects. To preserve biodiversity, buffer zones at the edges of crop fields with reduced application of fertilizers would enhance the quality of neighboring habitats. Still better, organic farming practices should serve as a standard rather than exception.



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**Oral presentation****Effects of irrigation on dry grasslands in Valais (Switzerland)****Meret Schindler<sup>1</sup>, Hallie Seiler<sup>1</sup> & Jürgen Dengler<sup>1, 2, 3</sup>**

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In the Swiss inneralpine dry valley of Valais, dry grasslands are commonly irrigated to improve productivity, with modern sprinkler systems gradually replacing traditional flooding irrigation. Since only a few studies have investigated the long-term effects of sprinkler irrigation on this vegetation, we resurveyed eight permanent plots subject to a 33-year irrigation experiment and analyzed a total of 40 paired (irrigated / non-irrigated) plots, with the aim of detecting possible effects of irrigation on biodiversity, plant life-history strategy, and ecological conditions. The starting and ending points of the time series were compared using paired t-tests, and the paired plots were analyzed using both paired t-tests and ANCOVA, with slope as covariant. Although a significant decrease in species richness was observed, the irrigated permanent plots showed no strong change in prevailing life-history strategy or environmental indicator values. However, light and soil reaction values showed trends towards increase. By contrast, paired plots differed significantly both in species richness and ecological characteristics, with the irrigated plots showing higher indicator values for soil moisture, temperature, competitive strategy, soil nutrient and humus content, and the non-irrigated plots showing higher values for continentality, soil reaction, soil aeration, and ruderality. The contrast in results between the permanent and paired plots may indicate long-lasting effects of the traditional flooding irrigation which ceased approximately 20 years before the beginning of the irrigation experiment.

## Poster presentation

**Vegetation management of the Budzhatskyi steppes  
(Odesa region, Ukraine)****Viktor Shapoval<sup>1</sup> & Vitalii Kolomiichuk<sup>2</sup>**<sup>1</sup>Biosphere reserve Askania Nova, Askania Nova, Kherson region, Ukraine<sup>2</sup>Taras Shevchenko National University of Kyiv, Kyiv, Ukraine[vkolomiychuk@ukr.net](mailto:vkolomiychuk@ukr.net)[shapoval\\_botany@ukr.net](mailto:shapoval_botany@ukr.net)

Budzhatskyi steppes are a valuable natural area located within the Bolhrad district of Odesa. In 2012, the Tarutyno Steppe landscape reserve was created on an area of 5,200 hectares, with the aim of protecting valuable steppe areas. In the greater part of this territory, the traditional nature management of the region is carried out (haymaking and grazing). The territory of the reserve is a key one, which, together with other adjacent lands, will soon be included in the projected national nature park «Budzhatskyi Steppes». A research project was carried out on this territory for 3 years (2020–2022). It is dedicated to monitoring the processes of restoration of the natural vegetation of the «Tarutyn Steppe» under different regimes of nature management within the former military training ground, also the implementation of measures to renaturalize fallows and optimize the condition of virgin areas of the steppe with its traditional hay and pasture use. As part of the project, 26 monitoring plots were laid out and described in order to assess the diversity of flora, the dynamics of vegetation recovery processes in the successional series. Its conditionally «reference» virgin land (minimum anthropogenic pressure), virgin land with grazing of wild ungulates (aviary complex), virgin land with perennial livestock grazing, virgin forest burn, representing post-pyrogenic succession, perennial virgin and fallow hay meadows, as well as a recently plowed steppe with deeply disturbed vegetation. These studies are conducted with the aim of modeling and adjusting non-exhaustive nature management regimes and determining optimal measures of renaturalization in steppe communities. Namely, the general course and rates of vegetation restoration processes are investigated in a spontaneous mode (in the absence of intervention), during grazing of wild ungulates and livestock, under the influence of pyrogenic influence and regular mowing, with the help of special technological techniques on plowed fallows. Research on the restoration of populations of wild ungulates in semi-free housing conditions with subsequent reintroduction into the natural ecosystems of the region is carried out separately. The main preliminary results of the project are the following. All little-disturbed experimental test areas of the natural-anthropogenic series are characterized by significant reserves of above-ground phytomass under a favorable moisture regime. In terms of species diversity and floristic richness, reference virgin areas, virgin areas under grazing, incl. an aviary complex where wild ungulates are kept. The most optimal regime of maintenance of preserved virgin areas is pasture with a normalized load. The renaturalization works carried out on the fallows, sowing of seeds of steppe cereals and forbs collected in the adjacent areas had a very positive effect on the current state and regeneration dynamics of vegetation. The pyrogenic influence is ambiguous and largely depends on the initial state of the vegetation, the frequency of fires, the climatic situation and the mode of use of the site.

## Poster presentation

**♣ Ancient defensive earthworks as refuges for steppe flora in Southern Ukraine****Ivan Moysiyyenko<sup>1</sup>, Olena Shchepeleva<sup>1</sup> & Victoria Bozhonok<sup>1</sup>**<sup>1</sup>Kherson State University, Department of Botany, Kherson, Ukraine  
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The steppes are one of the most transformed biomes in Europe. Thus, during our era, the area of virgin steppes in Ukraine decreased 40 times (from 40% of the territory to 1%) (Burkovskiy et al., 2014). Sites of cultural heritage are one of the few habitats where steppe biodiversity is preserved. This was clearly demonstrated by our research on kurgans (Moysiyyenko, Sudnik-Wójcikowska, 2007, 2008; Moysiyyenko et al., 2015, 2017; Moysiyyenko et al., 2014; Moysiyyenko, Sudnik-Wójcikowska, 2004, 2006, 2009; Moysiyyenko, Sudnik -Wójcikowska, Rowińska, 2010; Sudnik-Wójcikowska, Moysiyyenko, 2006, 2008, 2010, 2012, 2014; Dembicz et al., 2016; 2018; Deák et al., 2016, etc.), ancient settlements (Moysiyyenko et al., 2015, 2018, 2019, 2020; Moysiyyenko, Dayneko, 2019), old cemeteries (Moysiyyenko et al., 2021; Skobel et al., 2022) and old parks (Khodosovtsev, et al., 2019). According to preliminary data, another important site of preservation of steppe diversity is ancient defensive earthworks. The historical value of earthworks is well known (Fundukley, 1848, Antonovych, 1884; Kowalchuk, 1969; Bugay (ed.), 2011, etc.), while a special study of their natural component was not conducted in Ukraine. There are only incomplete data on individual earthworks (Parnikosa and Vasylyuk, 2010; Peregrym, Bezsmeretna, Komarenko, 2017). Ancient defensive earthworks were constructed in Antiquity and the Middle Ages. Well-known are the Troyan and Zmievi earthworks (Funduklei, 1848, Antonovych, 1884; Kowalchuk, 1969; Bugay (ed.), 2011, etc.). They were built to protect state borders from nomads. In Ukraine, these earthworks stretch for hundreds of kilometers in the Steppe and Forest-Steppe zone zones. We conducted reconnaissance studies of defensive earthworks in the steppe (fragment of the Troyan earthwork on the outskirts of Hlyboke village in Odesa region) and forest-steppe (the earthworks of Motronynske, Hotiv and Nemyrovske Late Scythian settlements, The Zmievi earthwork on the outskirts of Ivankovychi village) zones. Our studies have shown a significant differentiation of the earthworks` vegetation, in particular, we have identified steppe, meadow, shrub, forest and synanthropic communities on the earthworks. Some were completely overgrown with forest vegetation, such as the Motronynske Scythian settlement. The well-preserved steppe flora is represented at Bilhorod`, Vasylykiv`, Nemyrov` settlements and at the Zmievi earthwork in the outskirts of Ivankovychi village. Steppe communities occupy the tops and slopes of the settlements, while the foothills, especially on the northern side, are occupied by forest, shrub or meadow communities. In areas with well-preserved steppe vegetation, sod grasses dominate – *Stipa capillata*, *Agropyron pectinatum*, *Festuca valesiaca*, *F. rupicola*, *Koeleria cristata*. It also presents protected steppe plants, in particular, those included in the Red Book of Ukraine: *Stipa capillata* and *Pulsatilla pratensis* (Peregrym, Bezsmeretna, Komarenko, 2017), and those included in regional red lists (*Anemone sylvestris*, *Cerasus fruticosa*, *Gagea paczoskii*, *Gagea pusilla*, etc). Thus, previous studies have shown that ancient defensive earthworks, as well as other cultural heritage sites such as kurgans, ancient settlements and old cemeteries, and parks are an important refugium for step flora.

## Poster presentation

**♣ Old cemeteries of Grass-step of the Right-Bank of Dnipro Grass steppe zone as refuge of steppe flora****Nadiia Skobel<sup>1,2</sup>, Natalia Veychko<sup>1</sup>, Schepeleva<sup>1</sup> & Ivan Moysiienko<sup>1</sup>**<sup>1</sup>Kherson State University, Kherson, Ukraine<sup>2</sup>University of Warsaw, Warsaw, Poland[skobel2015@gmail.com](mailto:skobel2015@gmail.com)

Right-Bank of Dnipro Grass steppe zone to the Black Sea Southern Steppe Province of the Southern Steppe Subzone, and occupies partially or entirely the Danube-Dnister-S.Bug. Partially or fully occupies the Danube-Dnister, Dnister-Bug, and Bug-Dnister steppe areas of the Black Sea Lowland, the latter, according to the geomorphological zoning. Given the significant anthropogenic transformation and isolation of flora, the conservation of phytodiversity in small anthropogenic sites, such as old cemeteries, has become increasingly important. These cemeteries act as "islands" of natural flora in close proximity to urban areas, often serving as refuges for rare species and steppe plants. When referring to "old cemeteries," we mean cemeteries that were established in the 20th century or earlier, back when they were situated within the steppe region of southern Ukraine, unaffected by significant flora transformation. The study on old cemeteries as refuges of steppe flora was conducted from April 24, 2023, to May 2, 2023. A total of 386 species of vascular plants were discovered across 32 cemeteries. The conservation value of these cemeteries is significant, as evidenced by the presence of numerous species listed in the Red Data Book of Ukraine. These include *Adonis vernalis*, *Astragalus dasyanthus*, *Ornithogalum bousheanum*, *Ornithogalum refractum*, *Stipa capillata*, *Stipa lessingiana*, *Stipa ucrainica*, and even more regionally rare species. Some rare species, such as *Adonis vernalis*, *Paeonia tenuifolia*, *Betula borysthena*, are intentionally cultivated, while others are growing naturally. Furthermore, we collected functional traits for 65 steppe plant species, which is considered an exceptionally successful outcome. Acknowledgments to IAVS "Plant diversity and species-area relationships modelling of steppe enclaves within old cemeteries of Northern Prychornomoriia region (Northern Black Sea Region) of Southern Ukraine." and National Science Centre scholarship programme for Ukrainian students and young researchers (N.S).

## Poster presentation

**Functional traits of transient plant species in two semi-natural dry grassland communities****Sonja Škornik<sup>1</sup>, Ana Munda<sup>1</sup> & Nataša Pipenbaher<sup>1</sup>**<sup>1</sup>Faculty of Natural Sciences and Mathematics, Department of Biology, University of Maribor, SI-2000 Maribor, Slovenia[sonja.skornik@um.si](mailto:sonja.skornik@um.si)

While many characteristics of ecosystem function are disproportionately influenced by traits of the dominant species, subordinates and transients also may play critical, although sometimes temporary, roles in determining ecosystem function. The transient species are a heterogeneous assemblage of species with low abundance and persistence in community. However, by examining their origins and/or morphological functional traits (MFTs), we can predict which transient species might assume a subordinate or even dominant role within the vegetation as environmental factors, disturbance intensity, and stress change. In our study, we used Grime's DST classification model (Dominant, Subordinate, and Transient Plant Species) and analyzed transient species in two associations of semi-natural dry grasslands (app. 60 relevés, 183 plant species) from continental Slovenia: The *Onobrychido-Brometum* T. Muller 1966 association (OB) and the *Scabioso hladnikianae-Caricetum humilis* (Horvat 1931) Tomažič 1942 association (SC). The following data were collected for transient species: Habitat preference, Ellenberg indicator values, and 13 MFTs (e.g., life form, growth form, plant height, LDMC and SLA values, CSR strategies, etc.). Data were analyzed using various univariate and multivariate methods. We found higher share of transient species for OB grasslands. By comparing the habitat preference of these species, we were able to determine the significant differences in the surrounding landscape of each association. While in the association OB mainly fields, gardens and other intensively cultivated areas are the main sources of transient species, in the grassland of the association SC diverse forest and forest edge species are found. Ellenberg indicator values (EIVs) showed greater differences between the two groups of transient species in plant preferences for soil pH and nutrients, and smaller differences in requirements for light, temperature, and soil moisture. The studied species of both associations have the most pronounced competitive (C) strategy and differ in the importance of stress (S) and ruderal (R) components. We can assume that in both communities, changes that would improve growing conditions for plants (reducing disturbance and/or stress) would increase the number and coverage of transient species with strong C-strategy. In the OB association, there are several transient species with the CR strategy because disturbance and intensification are more intense in surrounding habitats. In the SC association, there are several transient species with the S strategy because stress in surrounding habitats is more intense. These results provide a valuable basis for future research aimed at linking specific environmental changes to changes in the floristic and functional composition of the grassland types studied.

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**Oral presentation****♣ Commercial potting substrates as an overlooked way of the long-distance dispersal of plants****Judit Sonkoly<sup>1,2</sup>, Attila Takács<sup>1,3</sup>, Attila Molnár V.<sup>1,3</sup> & Péter Török<sup>1,2</sup>**<sup>1</sup>University of Debrecen, Debrecen, Hungary<sup>2</sup>ELKH-DE Functional and Restoration Ecology Research Group, Debrecen, Hungary<sup>3</sup>ELKH-DE Conservation Biology Research Group, Debrecen, Hungary[judit.sonkoly@gmail.com](mailto:judit.sonkoly@gmail.com)

Long-distance dispersal (LDD) events are considered to be rare and highly stochastic, but they have a heavy influence on several large-scale ecological processes. However, despite the key importance of LDD events, we have a very limited understanding of their frequency, extent, and consequences. Humans deliberately spread numerous species, but it also results in the accidental dispersal of other organisms. The large-scale global trade of potted plants and horticultural substrates is able to disperse huge amounts of seeds and other propagules, but it has hardly been studied from an ecological point of view. To start filling this knowledge gap, we studied the viable seed content of 11 different types of commercial potting substrates to answer the following questions: (i) In what richness and density do substrates contain viable seeds? (ii) Does the composition of substrates influence their viable seed content? and (iii) Are there common characteristics of the species dispersed this way? We bought 3 bags of each of 11 different types of potting substrates and took samples of 1 liter from each bag. The viable seed content of the samples was determined by keeping the samples in an unheated greenhouse from spring until autumn with daily irrigation and regularly counting and identifying the emerging plants. Altogether, 438 seedlings of 66 taxa germinated from the samples. The most abundant species in the samples were widespread, common species, but some less frequent, rather sporadic species were also detected, together with five non-native species. We found that 1 l of potting substrate contained an average of 13.27 seeds of 6.24 species, meaning that a 20-liter bag of substrate contains 265 viable seeds on average. The seed content of the substrates was highly variable, because substrates containing manure had a much higher seed and species number than substrates without manure. Based on this, this pathway of LDD can be considered as an interplay between endozoochory by grazing livestock and accidental human-vectored dispersal. This also means that the diet preference of grazing animals influences the ability of a plant species to be dispersed this way. Based on our results, potting substrates are able to disperse large quantities of seeds of a wide range of species over huge distances. In conclusion, this kind of human-vectored LDD can have complex effects on plant populations and communities; but as this dispersal pathway is largely understudied and has hardly been considered as a type of LDD, the consequences are still unknown and further studies of the issue would be highly important.



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**Oral presentation****Where do reindeer graze? A study about the interplay between landscape features and grazing on plant communities in the warming tundra****Marianne Stoessel<sup>1,2</sup>, Emma Gemal<sup>1,2</sup> & Regina Lindborg<sup>1,2</sup>**

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In northern Fennoscandia, traditional free-ranging livestock grazing, in particular reindeer herding, is of high ecological, cultural and economic importance and upholding ecosystem services. As global warming is affecting tundra plant communities, grazing by reindeer can help counteract some of the climate-driven changes on vegetation, such as shrub encroachment. Yet, accurate monitoring of grazing pressure by reindeer and its effects on plants, remains a challenging task, as they can roam freely over wide remote areas in the Fennoscandian mountains. Actually, the relative importance of grazing versus abiotic factors on tundra plant community structure is still unclear, and understanding which factors will prevail at a local scale is vital in the context of climate change. Using innovative technology called tri-axial accelerometry, we could monitor movements of reindeer in 3-dimensions and modelled their grazing activities in space in the summers 2019 and 2020. Thanks to this dataset, we then identified reindeer grazing hotspots in which we sampled species richness and coverage of vascular plants, bryophytes and lichens (summer 2022). Finally, we examined the relative importance of reindeer grazing versus landscape features on the plant communities. The landscape factors, namely the aspect of the mountain (south or north-oriented slopes) and soil moisture, were the prevailing drivers of the local vegetation patterns. Reindeer grazing had a predictable but weak effect on species richness, with responses predominantly observed on south-facing slopes. Interestingly, we also found a negative interaction between soil moisture and reindeer grazing activities, with wetter areas grazed far less. Our results therefore demonstrate the importance of considering interactions between biotic and abiotic factors on plants. By remotely monitoring reindeer grazing activities, but also by proposing a more holistic approach to study these effects on plant communities, we conclude that our study enables a better comprehension of how tundra plant communities might change under future climate change in northern Fennoscandia.



## Oral presentation

**Habitat selection and breeding success of tree-nesting forest steppe birds in a restored grassland ecosystem****Márton Szabolcs<sup>1</sup>, Zsófia Orosz<sup>1</sup>, Csaba Péter Nagy<sup>1</sup>, Máté Tóth<sup>1</sup>, Petra Paládi<sup>1</sup>, Gábor Mészáros<sup>1</sup>, Béla Mester<sup>2</sup> & Szabolcs Lengyel<sup>1</sup>**<sup>1</sup>Centre for Ecological, Debrecen, Hungary<sup>2</sup>Hortobágy National Park Directorate, Debrecen, Hungary[lengyel.szabolcs@ecolres.hu](mailto:lengyel.szabolcs@ecolres.hu)

A vast proportion of grasslands of the Carpathian Basin have been converted to arable land, particularly upon the arrival of large-scale industrial farming. To halt and reverse biodiversity loss, national park directorates in Hungary started to restore grasslands on former croplands in the 2000s. Our study took place in the Egyek-Pusztakócs landscape unit (4000 ha) of Hortobágy National Park (E Hungary), where 760 ha of croplands were restored to grasslands between 2005 and 2008, resulting in a mosaic of natural and restored alkali steppes and loess grasslands, meadows, marshes, small patches of forests and tree lines, and low-intensity croplands. In 2012, we installed nestboxes on trees to study habitat selection and breeding success in two declining bird species of forest steppe habitats, the red-footed falcon (*Falco vespertinus*) and the European roller (*Coracias garrulus*). Since 2013, we monitored nestboxes by counting the eggs or chicks in the nest-boxes once every two weeks in the breeding season from May to July. We used these data to test the effects of year, nesting of competitor species and landscape structure on next box occupancy, nest initiation date and breeding success in the two study species. We quantified landscape structure by calculating the proportion of habitat types in buffers of 500 m radius around the nest boxes. Nestbox occupancy started at 40% in the first year and reached even 90% later, thus this method was successful for conservation. Nest box occupancy by red-footed falcons was high (30%) initially and decreased later (16-20%) due to competition with the earlier-nesting European kestrel (*F. tinnunculus*), and it was higher in less diverse landscapes. Red-footed falcon nests were started earlier in landscapes with more meadows and later in landscapes rich in restored alkali steppes and more natural habitats. Hatching success increased with habitat diversity and decreased with naturalness and the proportion of alkali steppes, whereas fledging success increased with the proportion of meadows, marshes and restored loess grasslands. Nest box occupancy by European rollers increased from 36% in 2013 to 83% in 2017 but decreased later (to 50%) due to competition with the earlier-nesting Eurasian jackdaw, and was higher in drier, more natural and more diverse landscapes. Roller nests were started earlier in landscapes with higher proportion of croplands. Clutch size and hatching success decreased with the date of nest initiation, but fledging success increased with landscape naturalness and the proportion of marshes and natural alkali steppes. Our results suggest that both natural and restored grasslands provide important resources to the two studied bird species in one or more phases of their nesting cycle. Our study thus attests that maintaining diverse habitats is essential for the conservation of declining bird species of forest-steppe landscapes.

## Poster presentation

**♣ The effect of kurgan area and isolation on *Salvia nemorosa* L. in fragmented dry grasslands**

**Vivien Szász<sup>1</sup>, Orsolya Valkó<sup>2</sup>, Balázs Deák<sup>2</sup>, Santiago Ordonez<sup>1</sup>, Krisztina Verbényiné Neumann<sup>3</sup>, Réka Kiss<sup>2</sup> & Anna Mária Csergő<sup>4</sup>**

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Steppe grasslands are one of the most threatened habitats in the world. As a result of agricultural intensification, these grasslands have undergone severe fragmentation and degradation. The steppe vegetation persists in isolated habitat fragments where human activity is limited, such as ancient, *ex lege* protected burial mounds, also known as kurgans. The overarching goal of our study was to examine the effect of kurgan area and isolation on the survival of short-lived, perennial herbaceous plants, using the model species *Salvia nemorosa* L. Specifically, we asked the following questions: (i) How does the kurgan area and isolation affect the vegetative and generative traits of *Salvia nemorosa* L.? (ii) Can increased herbivore pressure be detected in smaller, more isolated habitat patches? The study sites were located in the Great Hungarian Plain. We collected data on 12 kurgans of different areas and degree of isolation and two reference grasslands in the Hortobágy National Park. We sampled 8-20 individuals of *S. nemorosa* randomly at each locality, depending on the population size. We measured the number of shoots and height of the tallest stem in the field. The two largest leaves of the tallest stem were transported in the lab and scanned. In order to calculate the total area, the first step was to reconstruct the parts of the leaf that were missing due to herbivores. Herbivore pressure were calculated by subtracting the intact leaf area from the reconstructed leaf area. We collected and we weighted the mass of 4 x 25 nutlets/individual. These nutlets were subjected to seed germination at 25°C. We analysed the effect of the kurgan area and geographical distance of the focal grassland from patch from nearest natural grassland on the measured variables with linear mixed models. Isolation increased significantly the herbivore pressure on the *S. nemorosa* leaves, and it had a significant negative effect on seed germination rate and nutlet weight. Habitat area exerted a positive significant effect on seed germination rate. The results suggest that in the intensively used, degraded and transformed landscape studied, the remnant *S. nemorosa* populations may have suffered inbreeding depression due to small population sizes and reduced gene flow between populations. The local survival of the species can further be negatively affected by increased pressure from herbivores. As a conservation measure, we recommend increasing the local population sizes by correctly managing or restoring the grasslands where necessary, as well as improving the landscape structure by restoring the connectivity below the critical dispersal thresholds for autochorous plant species.

## Poster presentation

**♣ Vertical distribution of soil seed bank and the ecological importance of deeply buried seeds in alkaline grasslands**

**Ágnes Tóth<sup>1,2,3</sup>, Balázs Deák<sup>1</sup>, Katalin Tóth<sup>1</sup>, Réka Kiss<sup>1</sup>, Katalin Lukács<sup>1</sup>, Zoltán Rádai<sup>1</sup>, Laura Godó<sup>1</sup>, Sándor Borza<sup>1</sup>, András Kelemen<sup>1,2</sup>, Tamás Miglécz<sup>4</sup>, Zoltán Bátori<sup>2</sup>, Tibor József Novák<sup>5</sup> & Orsolya Valkó<sup>1</sup>**

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Soil seed banks play a central role in vegetation dynamics and may be an important source of ecological restoration. Since the area of natural grasslands is still rapidly declining, it is a significant task to conserve their species richness, to which soil seed bank studies may contribute. However, most seed bank studies examined only the uppermost soil layers (0–20 cm), hence our knowledge on the depth distribution of seed bank and the ecological significance of deeply buried seeds is limited. The aim of our study was to examine the fine-scale vertical distribution of soil seed bank to a depth of 80 cm, which is one of the largest studied depth gradients so far. Our model systems were alkaline grasslands in East-Hungary. We studied the depth distribution, the species composition, and the seedling density of the soil seed bank using the seedling emergence method. Soil penetration resistance was measured in situ next to each core location. Relationship between the depth distribution of the germinable seeds and the species traits were examined. During the study 402 seedlings germinated, corresponding to an overall seedling density of 15 870 seedling/m<sup>2</sup>. A total of 51 vascular plant species were identified. Germinable seed density and species richness in the seed bank decreased with increasing soil depth and penetration resistance. However, we detected 9 germinable seeds of 6 species even in the deepest soil layer. Forbs, grassland species and short-lived species occurred in large abundance in deep layers, from where graminoids, weeds and perennial species were missing. Round-shaped seeds were more abundant in deeper soil layers compared to elongated ones, but seed mass and ecological indicator values did not influence the vertical seed bank distribution. Our research draws attention to the potential ecological importance of the deeply buried seeds that may be a source of recovery after severe disturbance and emphasizes the need for similar studies in other habitat types.

**Oral presentation****How three decades of grassland restoration can develop to a long-term international research network?****Katalin Török<sup>1,2</sup>, Bruna Paolinelli Reis<sup>3</sup>, Miklós Kertész<sup>2</sup>, Katalin Szitár<sup>2,4</sup> & Melinda Halassy<sup>1,2</sup>**

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Grassland restoration experiments started in 1995 in the Kiskun LTER site by aiming to restore sand grassland at clear-cut black locust (*Robinia pseudoacacia*) stands by applying mowing and hay removal for seven years. Monitoring over a period of 22 years revealed that initial mowing assisted the restoration of Pannonian sand grassland, but further treatments are needed to control secondary invasion and increase target species cover. Later new treatments were tested at abandoned old fields, including seeding, carbon amendment and their combination. Gained experiences were gradually applied for the design of new projects. Seeding proved to be the most effective method to change the species composition of fallow land. The second most successful was mowing, however this treatment can have a side effect in the long term to help the survival of invasive species; carbon amendment is only suggested to be used in the early phase of restoration as a complementary method. The landscapes context can also have an impact of restoration success by providing target species pool, or can hamper development by high invasive infection. It was justified in different project that short-term and long-term outcomes of restoration treatments can be different. Results have been presented at conferences and mediated international contacts and reputation. In 2022 a questionnaire in two parts was launched to shed light on the restoration activities carried out at eLTER sites in Europe (<https://elter-projects.org/lter-sites>). 42 restoration projects reported on ongoing activities with more than half carried out in grasslands or non-forested areas. Participation in a recent workshop justified further interest in building closer network within the eLTER community. The development of an idea of a Topic Centre on restoration is in progress.

## Poster presentation

**♣ The relationship between seed size, shape and persistence in the Hungarian flora**

**Viktória Törő-Szijgyártó<sup>1,2</sup>, Péter Török<sup>1,2</sup>, Katalin Tóth<sup>1,2</sup>, Hajnalka Málík-Roffa<sup>3</sup>, Evelin Károlyi<sup>2</sup>, Oyundari Khashkhuu<sup>1</sup> & Judit Sonkoly<sup>1,2</sup>**

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One of the most important and most easily measurable physical characteristics of plant seeds is their weight, which influences and indicates crucial ecological processes. Seed mass affects spatial and temporal dispersal ability, and can also influence likeliness of seed predation and the germination, growth and survival of seedlings. The long-term persistence of seeds is especially crucial for short-lived species and for species of habitats with disturbed or unpredictable environmental conditions, as a persistent seed bank can smooth out year-to-year fluctuations in plant establishment and/or reproduction success. Knowledge of the persistence and germination of seeds is key to the control of allergenic plants, introduced plants and agricultural weeds, as well as to the conservation of rare and endangered species. It has been shown that there is a correlation between the size, shape and persistence of seeds. The mass of seeds has been plotted as a function of the variance of their three dimensions, which showed that all seeds are persistent within a range defined by a given maximum seed mass and variance in shape. Given the nature of the mechanisms underlying this phenomenon, this method may be applied to the flora of other regions as well, but some of the studies conducted in other regions produced contradictory results. The main objective of this study is to investigate the relationship between seed size, shape and persistence in the native flora of Hungary. Since seed size and shape, as well as persistence, can be influenced by a number of environmental conditions, it is important to use data from a specific geographical region with broadly similar climatic conditions to investigate this question. The seed collection of the ELKH-DE Functional and Restoration Ecology Research Group provides an excellent opportunity to measure seed morphological characteristics and to investigate the relationship between seed size, shape and persistence in the native flora. The Pannonian Database of Plant Traits (PADAPT) contains seed persistence data from domestic studies for about 500 species of the domestic flora, and we will be able to increase this number further by collecting the results of recent seed bank studies in our country. The seed weight of most of the species in the collection has already been measured and the weighing of seeds arriving to the collection is ongoing. In the meantime, the length and width of the seeds are measured using microscope photos and the thickness is determined using a digital thickness gauge. After collecting seed size and shape data for the species that have seed bank persistence data from Hungary, we will be able to determine if the correlation between the size, shape, and persistence of seeds also holds for the regional flora. As the exploration of this relationship may allow a more accurate estimation of long-term viability for a wide range of species in Central Europe, the expected results have considerable theoretical and practical importance.

## Poster presentation

**Monitoring polygons of steppes and Azov-type spits: application of remote sensing data for assessing the status of vegetation cover****Vasyl Tkachenko<sup>1</sup>, Oksana Tyshchenko<sup>2</sup>, Volodymyr Tyshchenko<sup>3</sup>, Viktor Shapoval<sup>4</sup> & Hennadii Lysenko<sup>5</sup>**<sup>1</sup>Ukrainian Botanical Society, Kyiv, Ukraine<sup>2</sup>Taras Shevchenko National University of Kyiv, Kyiv, Ukraine<sup>3</sup>State Ecological Academy of Postgraduate Education and Management, Kyiv, Ukraine<sup>4</sup>Biosphere Reserve "Askania-Nova" named after F.E. Falz-Fein, NAAS, Askaniia-Nova, Ukraine<sup>5</sup>Mykola Gogol State University of Nizhyn, Nizhyn, Ukraine[oksana\\_tyshchenko@knu.ua](mailto:oksana_tyshchenko@knu.ua)

As stationary polygons for monitoring natural processes and long-term changes in vegetation cover, well-preserved areas resembling the standard steppe regions of Ukraine, along with the coastal spits of the Northern Pryazovia (Kryva, Bilosaraiska, Berdianska, Obitychna, and Fedotova) featuring predominantly intrazonal vegetation, were selected within Sumy, Luhansk, Donetsk, Zaporizhzhia, Kherson, and Mykolaiv regions. The steppe vegetation polygons, including reserves such as Mykhailivska Tsilyna, Khomutovskyi Steppe, Kamiani Mohyly (Ukrainian Steppe Nature Reserve), Striltsivskyi Steppe, Provalskyi Steppe (Luhanskyi Nature Reserve), Yelanetskyi Steppe, and the F. E. Falz-Fein Biosphere Reserve "Askania-Nova," were established by V. Tkachenko in the 1960s and surveyed approximately once every 10 years, involving the work of Ukrainian researchers on different research steppe sites (A. Henov, V. Osychniuk, V. Havrylenko, V. Shapoval, H. Lysenko, and others). The monitoring series was typically complemented with existing classic research materials from the 1920s–1950s, including works by M. Shalyt, Yu. Kleopov, M. Bilyk, M. Kotov, S. Kharkevych, F. Gryn, and others. Monitoring sites on the Azov-type spits were established in the 1990s by O. Tyshchenko. The initial state of these sites was determined using vegetation maps published by S. Postrygan (1927-1929 for Kryva, Bilosaraiska, and Berdianska spits), M. Kotov (1927 for the loess island Stepok embedded in Fedotova Spit), and P. Popovych (1934 for Obytychna spit). Due to the dynamic nature of the spits, their vegetation cover undergoes changes in response to climate and environmental factors, necessitating repeated studies. However, monitoring studies were interrupted for most sites due to the outbreak of the Russian full-scale war in 2022 and restricted access to these territories. The aim of this study is to continue monitoring the vegetation cover on these polygons using remote sensing methods. The availability of satellite imagery enables the verification of previous forecasts and hypotheses concerning the causes and consequences of vegetation cover changes during the Russian military aggression, while protected areas of Ukraine remain occupied within the combat zone and face significant mining and infrastructure damage. The criteria for assessing vegetation cover status include the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Moisture Index (NDMI). Preliminary results of the long-term dynamics of NDVI and NDMI changes have been obtained for tracking vegetation cover changes in the "Pivnichna" site of the Askania-Nova Biosphere Reserve. These results demonstrate that studying vegetation index dynamics based on high-resolution remote sensing imagery enables tracking the overall trend of vegetation cover changes in steppe area when field research is not feasible. This ongoing research is being conducted for Azov-type spits and is planned for other steppe monitoring polygons.



## Poster presentation

**What impact does grassland abandonment have on forage quality compared to mowing?****Domas Uogintas<sup>1</sup>, Eglė Norkevičienė<sup>2</sup>, Vaclovas Stukonis<sup>2</sup> & Valerijus Rašomavičius<sup>1</sup>**<sup>1</sup>Nature Research Centre, Vilnius, Lithuania<sup>2</sup>Lithuanian Research Centre for Agriculture and Forestry, Akademija, Lithuania[domas.uogintas@gamtc.lt](mailto:domas.uogintas@gamtc.lt)

Grassland habitats are among the most threatened habitat types worldwide due to various reasons. Some grasslands have been converted into arable lands or forestry plantations, while others have been abandoned due to socio-economic factors. The results of EU habitat mapping in Lithuania have revealed a similar global trend, showing that the quality of grassland habitats is low and declining primarily due to a lack of mowing or grazing or contractionary due to intensive management. The introduction of new rules and regulations regarding subsidies for farmers working in Natura 2000 sites has sparked a discussion on the best way to manage grasslands in terms of biodiversity and forage quality. Environmentalists argue in favour of mowing or grazing sensitive areas every second year to protect nesting birds, while farmers disagree due to concerns about decreasing forage quality in those areas. In our study, we aim to investigate the impact of grassland abandonment on forage quality, are there significant differences between mown and abandonment grasslands. The study takes place in semi-natural grasslands in Lithuania. We established twin plots in areas where one plot was in an abandoned part of the grassland, while the other was in a managed part. We collected standing biomass and litter samples for forage quality analysis at each site. Forage quality was evaluated based on dry matter digestibility, raw protein, crude fibre, neutral detergent fiber, modified acid detergent fiber, lignin, and water-soluble carbohydrates. Additionally, we collected vegetation plots to evaluate species diversity and soil samples for chemical analysis, including soil reaction, total nitrogen, humus, soluble potassium, and phosphorus. The study is ongoing, and preliminary results have not shown a clear pattern across mown and abandoned communities that would indicate a decrease in forage quality in abandoned communities. Instead, it suggests that the variation in forage quality may be more related to the actual species composition rather than the type of management.



## Oral presentation

**Burrowing rodents as ecosystem engineers in Eurasian grasslands – case studies from Kazakhstan and Hungary****Orsolya Valkó<sup>1</sup>, András Kelemen<sup>1,2</sup>, Orsolya Kiss<sup>3</sup>, Csaba Tölgyesi<sup>2,4</sup>, Zoltán Bátori<sup>2,4</sup>, Róbert Gallé<sup>5</sup>, Tatyana M. Bragina<sup>6</sup> & Balázs Deák<sup>1</sup>**<sup>1</sup>'Lendület' Seed Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research, Vácrátót, Hungary<sup>2</sup>Department of Ecology, University of Szeged, Szeged, Hungary<sup>3</sup>Institute of Animal Sciences and Wildlife Management, University of Szeged, Hódmezővásárhely, Hungary<sup>4</sup>MTA-SZTE 'Lendület' Applied Ecology Research Group, Szeged, Hungary<sup>5</sup>'Lendület' Landscape and Conservation Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research, Vácrátót, Hungary<sup>6</sup>Kostanay Regional University named after A. Baitursynov, Kostanay, Kazakhstan  
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Environmental heterogeneity is a crucial driver of the biodiversity patterns in grasslands. Heterogeneity acts at different spatial scales from microrelief to mountain ranges. At intermediate scales, several natural features can introduce a high level of environmental heterogeneity to plain lowland landscapes. In the two presented case studies, we evaluated the vegetation composition of rodent burrows created by two ecosystem engineer species: i) the Steppe marmot (*Marmota bobak*) in Kostanay Oblast, North-Kazakhstan that builds large burrows in closed feathergrass steppes and ii) the Lesser blind mole rat (*Nannospalax superspecies leucodon*) in the Hungarian great plain that builds smaller burrows in open sandy grasslands. In both studies, we compared the vegetation of rodent burrows with the surrounding undisturbed dry grasslands to identify differences in species composition and plant functional groups. In both studies, burrows were characterised by lower vegetation cover, higher cover of annuals and lower cover of perennial grasses compared to the undisturbed grasslands. There was an increased cover of ruderal species on the burrows, but also several specialist species, such as *Agropyron cristatum*, *Anabasis salsa*, *Kochia prostrata*, and *Petrosimonia* spp. were confined to the marmot burrow vegetation. We found in both studies that the vegetation of the burrows was structurally and compositionally different from the intact steppe vegetation. The species composition of the lesser blind mole rat mounds and undisturbed grasslands was not different when considering all the sites together; however, looking at the site level we found marked differences in three of the four study sites. The ecosystem engineering effect, i.e., the contrast between the patches and the matrix was the largest in the more closed grasslands. Our results suggest that rodent burrows are crucial features in dry grasslands, which increase environmental heterogeneity, and provide suitable establishment sites and act as stepping stones for the dispersal of several habitat-specialist plant species.

## Oral presentation

**The effects of management on plant and carabid diversity of sub-arctic riparian flood meadows in northwestern Finland****Stephen Venn<sup>1</sup> & Andrea Desiderato<sup>1</sup>**<sup>1</sup>Department of Invertebrate Zoology & Hydrobiology, University of Lodz, Łódź, Poland  
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The Helmi (Pearl) programme was launched in 2020 as a national level, government programme to enhance the biodiversity of selected vulnerable habitat types, one of which was semi-natural grasslands. Finland has a diverse range of semi-natural grassland habitats, most of which are classified as threatened. One of the predominant types of semi-natural grasslands in the region of Kainuu, in northwest Finland, is riparian flood meadows, including dry flood meadows, with a sandy soil and diverse assemblages of forbs, and wet meadows, characterised by large grasses and sedges. These meadows are located along the riverbank, mostly on sandy soils. They have traditionally been cut by local farmers for hay production, as winter fodder for domestic livestock. Such traditional management has been in decline already since the 1960s and many meadows have become overgrown. However, since the late 1980s, management of many meadows has been resumed by Parks and Wildlife Finland, primarily for conservation purposes. The flood meadows are inundated with water for a period of a few weeks during the spring, when the snow melts, and sometimes also during the autumn. The vegetation of 100 sites along the Oulanka and Korouoma rivers under varying levels of management, was surveyed during 2020-2021. A total of 294 species of vascular plants were recorded, including 47 notable species (indicator and uncommon species). A number of invertebrate taxa, including bees, Diptera and Coleoptera were also sampled. I used PerMANOVA analysis to test the effects of watershed, management intensity, site area and area under management on plant species composition. Additionally I used PCoA ordination to look for patterns on the basis of plant species composition. Preliminary analyses of a subset of the full data indicated that the main factor affecting the vegetation composition was watershed, suggesting that local factors are important. There was also an effect of location on species richness, suggesting that local factors may affect species diversity more strongly than management, for instance, though management is important for the conservation of many important species. Now I will present findings based on analysis of the full dataset of 100 sites. The carabid community of these meadows is dominated by grassland species, varying according to the moisture level and density of vegetation. There is also a community of riparian species, that inhabit the wet margin of flooded areas, following it as the water recedes. Because these meadows are generally surrounded by a matrix of forest habitat, there is also a component of forest species. The beetle assemblage included a small number of noteworthy carabid species: *Chlaenius costulatus* (VU), *Cicindela maritima* (VU), *Dyschirius angustatus*, *Amara ovata* and *Bembidion fellmani*, as well as the Chrysomelid *Chrysomela cuprea* (NT). As the study region is close to the Arctic Circle, the carabid assemblage is restricted to northern species. I will present findings on the community composition of the carabid communities of flood meadows of northwestern Finland and consider the effects of environmental factors, such as management regime, on the diversity of the vascular plant and carabid assemblages.

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**Oral presentation****Mob grazing: A new approach to grazing management on British farms producing pasture-fed livestock****Markus Wagner<sup>1</sup>, Claire Waterton<sup>2</sup> & Lisa Norton<sup>3</sup>**<sup>1</sup> UK Centre for Ecology & Hydrology, Wallingford, United Kingdom<sup>2</sup> Department of Sociology, Lancaster University, Lancaster, United Kingdom<sup>3</sup> UK Centre for Ecology & Hydrology, Lancaster, United Kingdom[mwagner@ceh.ac.uk](mailto:mwagner@ceh.ac.uk)

Mob grazing is considered a nature-based solution that can boost sustainable livestock productivity by optimizing pasture management. Already well-established in North America, it is now receiving increased attention in Europe, including in the United Kingdom. However, as it is still a relatively new approach there, its implementation by British farmers has so far remained largely unexplored. To change this, we studied how and why mob grazing is being adopted by British pasture-fed beef farmers. We collected field-level grazing management information on 15 farms and analyzed this information using cluster analysis and ordination analysis, thus establishing a gradient of mob grazing implementation. Farmer interviews explored general farming context, and rationale and motivations underpinning each farmer's grazing approach. Four main rotational approaches were identified at the field level:

- (1) conventional non-mob stocking by farmers in the initial stages of discovering mob grazing;
- (2) mob stocking, involving reduced grazing duration at increased stocking densities, with pasture rest periods similar to those used in conventional rotational non-mob stocking;
- (3) mob grazing, involving similar stocking densities as in mob stocking, but allowing for longer rest periods;
- (4) intensive mob grazing using very high stocking densities and frequent cattle movement, allowing for even longer rest periods.

Interviews revealed the shift to mob grazing as a gradual process of farmer adaptation, involving the need to overcome constraints such as fencing and water access. Some early adopters amongst our sample of farmers indicated that they had observed benefits to sustainability of livestock production, soil and ecosystem health, and animal health. Many of the farmers in our sample stated that they were, in varying degree, influenced by holistic grazing approaches. In addition to the fact that many farmers have only recently begun to implement mob grazing approaches, both the 'systems' basis underlying such approaches, as well as the variation in their implementation, pose additional challenges for a more systematic investigation of soil and ecosystem effects of mob grazing. It is suggested that interdisciplinary and longer-term investigations may be most appropriate for exploring such mob grazing effects.

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**Oral presentation****♣ Elevational patterns in calcareous grassland community diversity and flower colour spectra in the European Alps****Svenja Wanke<sup>1</sup>, Andreas von Heßberg<sup>1</sup>, Anke Jentsch<sup>1</sup> & Mani Shrestha<sup>1</sup>**<sup>1</sup>Disturbance Ecology, University of Bayreuth.  
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Elevational gradients in high mountain ranges are particularly suitable to study patterns and drivers of plant community diversity, including plant functional trait distribution relevant for trophic interactions. However, there are only few studies that explicitly address, for example, flower resources for pollinators across the European Alps. Pollination plays an important role in structuring plant communities, yet pollinators are not evenly spread along elevational gradients. Since flower colour is under selection by pollinators, it is also expected to change with elevation. Recently, the significant discrepancy between flower colour vision by human eyes versus pollinator eyes has been discussed, which must be taken into account when considering the relationships between flower colour diversity and pollinator availability. We surveyed the plant diversity and measured flower colour spectra within three highly diverse limestone alms across an elevational gradient: (1) Hohe Leite near Bayreuth (500 m, Germany), (2) Brunnenkopf Alm in the Ammergebirge (1600 m, Germany) and (3) Hohe Mut at Obergurgl in the Ötz Valley (2600 m, Austria). The plant communities were sampled according to the Eurasian Dry Grassland Group (EDGG) standardized sampling method. Additionally, we collected flowers or petals of all locally occurring, insect-pollinated plants and measured their light reflectance properties using ocean optics spectrophotometer. We used the ‘bumblebee color vision model’, because bumblebees are representative insect pollinators from low to high elevation in the European Alps. Total species richness on 10m<sup>2</sup> ranged from 33 to 39 and showed a unimodal relationship with elevation, with a maximum at 1600m. The discrepancy between human and pollinator vision increased with elevation: while for human eyes ‘white’ and ‘yellow’ flowers increased with elevation, for bee eyes ‘blue’ and ‘green’ flowers increased.

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**Oral presentation****Epochal changes in grassland diversity in Switzerland****Stefan Widmer<sup>1</sup>, Jürgen Dengler<sup>1</sup> & Square Foot Consortium**

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Over the last century, there has been a severe anthropogenic biodiversity loss. However, assessments of diversity loss are mostly based on indicators or time series of observations with spatial (local) or temporal (one to few decades) restrictions. In the Square Foot project, we use a historical dataset which contains 580 0.09-m<sup>2</sup> vegetation plots, sampled between 1883 and 1931 in grasslands across Switzerland, for a vegetation resurvey. The researcher who recorded the historic plots (HP) aimed to characterise the grassland types in Switzerland as a prerequisite to increase their productivity. Therefore, the HP cover a wide range of grassland types along the elevational gradient of Switzerland. The HP plots were sampled with an exact method. The researchers cut out a 0.3 m × 0.3 m (“square foot”) sod and measured the above-ground dry weight of each species. For each HP, we defined a so-called potential area where the HP most likely had been located. The definition of the potential area was mainly based on the description of the location, which normally includes at least an old location name and the elevation. Depending on the size of the potential area (= proxy for spatial heterogeneity) still covered with grassland we sampled, 3-5 randomly distributed new replicate plots at a similar time of the year as the HP. For each replicate plot, we estimate the cover of each species and collect several environmental data like soil depth, aspect and position and data about the vegetation stand. Furthermore, we took a soil sample for each replicate plot to measure pH. Within a potential area the mean vegetation dissimilarity between the replicate plots was lower than the mean dissimilarity between the HP and the replicate plots. Demonstrating that the temporal change in vegetation is greater than spatial heterogeneity of the potential area. A mixed model, with the potential area as a random effect, showed that species richness is significantly lower in the replicate plots than in the HP. The difference in species richness between the HP and the replicate plots decreased with the elevation gradient.