

17th Eurasian Grassland Conference

Grassland dynamics and conservation in a changing world
Tolosa, Spain, 12-18 September 2022

Book of abstracts



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Abstracts Keynote lectures

Diversity, management and conservation of natural and semi-natural grasslands in Spain

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Spain is a country with an amazing diversity of natural and semi-natural grasslands. Most of them are major components of old cultural landscapes and/or High Nature Value Farmland. That is why their conservation, and that of their associated biodiversity (flora, fauna, habitats of community interest and traditional livestock breeds), requires suitable management: extensive and diversified land-use systems that are based on traditional ecological knowledge but should be implemented under our current Common Agricultural Policy.

This keynote lecture provides an overview of the diversity of natural and semi-natural grasslands in Spain and their associated biodiversity. Also, on their conservation status and on the effects of changes in their management on it during the last decades.

Natural and seminatural grasslands of Spain could be included into four major types: mountain pastures, mesophytic grasslands, perennial Mediterranean grasslands and annual grasslands.

The most important direct driver for biodiversity loss in Spain is not overexploitation nor the advance of the agricultural frontier, but, on the contrary, land use changes, depopulation and loss of traditional management of old cultural landscapes.

Species-rich semi-natural grasslands of Europe – historical masterpieces of human-nature interaction

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Examples of positive impact of humans on ecosystem biodiversity are rare. One of the phenomenal examples are species-rich secondary grasslands of Europe, which were formed during centuries as a consequence of low-intensity farming. Their maintenance is a main goal of current grassland conservation. During the last six years, we studied traditionally managed grasslands in 38 villages including eight countries of the Carpathian Mountains. Along with the biological and ecological data, we recorded a detailed information on grassland management practices applied. The data obtained so far are stored in the “Grassland with Tradition” database, registered in the Global Index of Vegetation-Plot Databases (GIVD, ID EU-00-032). In my presentation, I will first introduce the sampling methodology to survey traditionally managed grassland ecosystems holistically, including abiotic, biological and cultural phenomena, and reflect thus the multidimensionality of traditional farming. Second, an overview of diversity analyses will follow, evaluating multitaxon diversity parameters of study sites and plots at several spatial scales. Finally, I will focus on examples of traditional grassland management practices, which could have positive effects on grassland biodiversity if applied in grassland conservation of rural regions or ecological restoration of modern agricultural landscapes. A special attention I will pay to various combinations of mowing, grazing, and manuring, which may provide sustainability for biodiversity and productivity of rural agroecosystems. The effects of changing climatic conditions and the EU agri-environmental measures on species-rich mountain grasslands will be mentioned, too.

Diversity and conservation of grasslands and other open vegetation types in Tajikistan

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The geographical location of Tajikistan is favourable to high vegetation diversity. Positioned between the continental Asian deserts (Takla-Makan) in the east and vast warm lowlands in the west, linked with Himalayan through the Karakorum ridge in the south-east, Kunlun in the east and Tian-Shan in the north-east, with other connection by Hindukush and Kopet-dagh in the south-west and west. It has all vertical belts from hot to permafrost deserts offering an outstanding range of habitats. With one of the largest altitudinal amplitude in the world, extreme precipitation and temperature fluctuations, a considerable glacier cover and diverse geology, the country promotes a great number of plant species and their communities. This resulted in speciation of many altitudinal and ecological vicariants that occur in many cases in single, isolated valley or mountain ridge. Additionally, this shapes the unique environment for plant community's development, including vegetation classes that are going to be endemic to the Irano-Turanian phytogeographical region (e.g. pistachio open woods).

The vegetation of Tajikistan is fairly diverse and can be divided into 23 main types: mesophilous deciduous forests (so called Chernolesya), riverside forests (Belolesya), river-bed and gallery forests (Thugay), xerothermophilous shrublands (Shiblyak), alpine coniferous forests (Artschevniki), river-bar vegetation, lowland and montane meadows and pastures, segetal vegetation, alpine meadows and swards, steppes, pseudosteppes (secondary grasslands in steppe zone), open woodlands, xerophilous dwarf bushes, desert and semi-desert vegetation, fen and spring vegetation (sazy), tall-forbs, littoral vegetation, aquatic vegetation, scree and slide-rock vegetation, rock vegetation (petriphyton) and salt-marsh vegetation. Within this vegetation types approx. 250 plant communities were distinguished until now, however there are still a considerable gaps in the phytocoenotic knowledge, particularly regarding the Kobresia mats and alpine grasslands, leaving the complete list unresolved.

The research team of polish botanists has launched the project of vegetation classification and mapping in Middle Asia in 2006 focusing on vegetation survey, functional diversity of plant communities and conservation assessments of its rich flora. In his keynote lecture, team leader will present an overview of the diversity of open habitats occurring in Tajikistan (steppes, pseudosteppes, semi-deserts, mires, salt-marshes, alpine meadows and pastures) with some remarks to their conservation status and perspectives.

Abstracts

Oral and poster presentations

Oral Presentation

Protecting the habitat or protecting the species? An integrated approach to conserve two threatened insects and their habitats from the grasslands of Southern Italy**Leonardo Ancillotto¹ & Rocco Labadessa²**¹ Wildlife Research Unit, Dipartimento di Agraria,

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Aims. Organisms sharing the same habitat may differ in their favorable environmental conditions, or benefit from different management options. This is particularly relevant in the case of species and habitats of conservation concern. Consequently, assessing ecological requirements and conservation coverage of species from the same habitat is key to identify and optimize conservation planning. Here, we use two species of conservation concern that share similar and protected grassland habitats as models to i) test their association with protected grasslands as listed by the Habitats Directive, and ii) assess their conservation coverage by the Natura2000 network of protected areas. Namely, we selected two iconic insects, i.e. *Saga pedo* and *Melanargia arge*, both occurring in grasslands habitats of conservation concern, yet diverging in their ecological and biological traits.

Methods. We followed an integrated approach at two spatial scales, by combining species distribution models (SDMs), environmental niche factorial analysis (ENFA) and spatial gap analysis, using climate data and fine-scale EU habitat mapping to model both species' ecological niches and conservation coverage. We set our study at two spatial scales, first encompassing the entire Mediterranean basin, and then focusing on a testing area from Southern Italy.

Results. At the Mediterranean scale, both species are strongly associated with specific bioclimatic conditions, only partly overlapping. At the regional scale, their distribution is still affected by climate, but also strongly associated with protected grassland habitats, namely Eastern sub-Mediterranean dry grasslands (code 62A0) for both species, and pseudo-steppe with grasses and annuals (code 6220*) for *S. pedo* only. The N2000 network shows a good coverage for potentially suitable areas in Southern Italy (ca. 60% for both species), with an evident bias when considering actual records (ca. 50% for *S. pedo*, 80% for *M. arge*), probably as a result of a stronger trophic association between *M. arge* and plant species of dry grasslands.

Conclusions. Taken together, our results indicate that the two target species differ in their ecological requirements and so do the conservation strategies needed to guarantee their long-term persistence, besides providing an effective example to evaluate the conservation coverage of poorly known grassland arthropods.

Oral Presentation

Landscape Decision System for Sustainable Grassland Management Through Spatial Modelling Tools**Muhammad Naveed Arshad¹, Iain Donnison¹, Rebecca Rowe², Mariecia Fraser¹**¹ Institute of Biological, Environmental and Rural Sciences,
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Changes to the climate could radically alter upland agriculture. Larger areas in Europe have been classified as marginal where cost of arable crop production is high. There is considerable potential to improve agricultural productivity and grasslands can play a big role in farming's net zero carbon goals through sustainable management.

Question (Aims). For perennial grasses as bioenergy crops there is an urgent need to develop better landscape decision tools keeping in view the biodiversity and food security. Landscape decision system can support land use diversification under current and future climate scenarios.

Methods. Process-based crop model MiscanFOR was run at the field scale to calibrate and evaluate the model and estimate net carbon storage and dry matter yield of key crop species of Wales. The calibrated model was then run at a resolution of 1 km² for all of Wales using UKCP18 gridded weather and soil data to forecast dry matter yield showing potential suitable areas for each crop. Designated areas and areas under non-agricultural land use were filtered out from the analysis. A system approach was implemented to make land use decision making on regional scale.

Results. The system reveals that miscanthus and willow as bioenergy crops are suitable for upland and marginal areas and could play an important role in mitigating greenhouse gas emissions and combating climate change. Further studies with future scenarios using spatial modelling will help to develop adaptation strategies and recommendations for alternative crops and climate-resilient farming.

Conclusions. Within the Supergen Bioenergy Hub we have sought to address climate related challenges utilising spatial modelling tools and sustainable grassland management and to support land use decision-making facilitating evidence-based decisions through research collaboration with policymakers, industry and research institute partners, and identifying hotspots for bioenergy development or deployment throughout the UK.

Oral Presentation

Interacting indirect and direct drivers of grassland changes at local, regional, and country scales**Marianna Biró¹, Kinga Öllerer^{1,2}, László Demeter¹, János Bölöni¹, Zsolt Molnár¹**¹ Institute of Ecology and Botany, Centre for Ecological Research, 2163 Vácrátót, Hungary² Institute of Biology Bucharest, Romanian Academy, 060031 Bucharest, Romania

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Multi-scale analysis of drivers behind grassland change at the decades or century-scale is rare as it needs the understanding of complex socio-economic processes behind the vegetation changes.

We analyzed habitat change trajectories and direct drivers of grassland changes at local, regional, and country scales. We also connected our ecological assessment with the knowledge of local land-users, historical maps, archival aerial photos, satellite imagery, and recent field data, using these especially for showing the direct and indirect driving forces of the last decades.

At the country scale, our results showed that semi-natural grasslands and wetlands lost 85% and 77% of their original area during the last 230-years period in Hungary, respectively. Direct drivers behind the semi-natural grassland loss were habitat-specific as the change trajectories were different for the studied grassland habitats both regarding time and in their quantity. We emphasized the importance of changes in the communist era, and around and after the fall of communism. In the communist era, the area of secondary grasslands has more than quintupled since the 1960s, meanwhile, the area of semi-natural grasslands has shrunk by about half in Hungary. The average annual loss rate of habitats from 1961 to 1986 was 0.89%. During the next period, when communism collapsed, the average annual loss rate increased slightly (0.95%), but after Hungary's accession to the EU, it decreased considerably (0.46%). The regional scale analysis showed that grassland loss rates could reach 1.3% in some areas. Direct drivers behind this loss were plowing, afforestation and construction. These changes were driven by various natural and social-economical indirect drivers, e.g. population density, annual income, distance from settlements and roads, or level of protection.

We pointed out that land-cover level is not enough to study trajectories of habitat changes, instead, finer-level categories are needed such as the habitat and habitat-based landcover categories. Understanding these long-term processes of habitat transformations is not only important in highlighting the importance of habitat conservation and protection, but also in predicting the impacts of future habitat management and restoration interventions.

Poster Presentation

Environmental niche and leaf morphological traits in the Iberian open shrubland species *Santolina semidentata* Hoffmanns. & Link. and allied taxa

**Rodrigo Carballal¹, Miguel Serrano¹,
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Question (Aims). The Iberian endemic *Santolina semidentata* and two allied taxa occur in open shrubland habitats in central and north-western Iberian Peninsula with allopatric or slightly overlapping ranges, indicating different environmental envelopes. Leaf morphology is a key character defining taxonomic entities within the group. Leaf traits and environmental variables are closely related in many plant groups, and the adaptive significance of leaf morphology beyond mere taxonomical assignation is worthy of study for hypothesizing evolutionary processes, such as ecological adaptation or introgression in overlapped ranges.

Methods. Morphological measurements were carried out on 33, 32 and 11 individuals of *S. semidentata*, *S. rosmarinifolia* and *S. rosmarinifolia* subsp. *castellana*, respectively, covering the whole range of the taxa. Three different types of leaves and 12 morphological traits were measured. The five most informative characters were selected after correlation and PCA analyses. Ensembled environmental models were constructed with 19 Worldclim environmental variables. Morphological-climatic correlations and significance were assessed by analysis of redundancy and ANOVAs.

Results. The main informative characters for defining taxa are those related to lobes and overall leaf area. Values in these variables were higher in *S. semidentata* and lower in *S. rosmarinifolia*, and those in *S. rosmarinifolia* subsp. *castellana* were intermediate or overlapped with those of the latter (*S. rosmarinifolia*). Less xeric summer (i.e. submediterranean) environmental conditions and colder winters were significantly correlated with shorter leaves with a larger surface area and more lobes, i.e. traits more frequently found in *S. semidentata*. SDMs provided good fits for the current distribution of this species, with broader projections for *S. rosmarinifolia* and especially for *S. rosmarinifolia* subsp. *castellana*.

Conclusions. Leaf morphological traits seem to play a role in adaptation to the environmental features of Iberian dry open habitats. The shorter but wider and more lobed leaves of *S. semidentata* are suited to the submediterranean belt of NW Iberia, but could hamper expansion to drier southern habitats. Conversely, the narrow and linear leaves of *S. rosmarinifolia* enable a broad distribution across Iberian open habitats. Intermediate morphological values of *S. rosmarinifolia* subsp. *castellana* and a large but not well-defined SDM area may indicate introgressive processes between the other taxa as the origin of this subspecies.

Poster Presentation

Botanical composition of pasture grassland under Mediterranean forest rangeland of Northern Morocco**Y. Chebli¹, M. Chentouf¹, J.F. Cabaraux², S. El Otmani¹**¹ Regional Center of Agricultural Research of Tangier,
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Question (Aims). Mediterranean forest rangelands are rich in plant species and life forms. These areas represent the most crucial feed source for livestock. Pastoral systems are characterized by integrating pasture with forage and livestock production. These pastures could be natural, improved, or cultivated. In Northern Morocco, there is no available data about the botanical composition of pasture grasslands. This study aimed to assess the floristic diversity of a Mediterranean pasture grassland under forest pasture located in Chefchaouen (Northern Morocco).

Methods. Based on our prior botanical knowledge, plant identification was carried out directly in the field. We relied on the survey with several herders who explored the pasture grassland to identify local plant names. In each sampling period, plant species were collected to determine the seasonal floristic composition.

Results. An important number of pastoral plant species characterizes the studied forest rangeland. The botanical composition of the studied forest rangeland had significant variation regarding season and grazing intensity. An average of ninety-eight plant species was identified and classified. Three distinct vegetation groups dominate the studied forest rangeland: shrubs, trees, and herbaceous, mainly grasses. The common plants' species identified in the pasture grassland were *Aira caryophyllea* L., *Anthoxanthum odoratum* L., *Avena alba* auct., *Brachypodium distachyon* L., *Briza maxima* L., *Bromus mollis* L., *Bromus rigidus* Roth., *Cynodon dactylon* (L.) Pers., *Cynosurus echinatus* Mill., *Gaudinia fragilis* (L.) P.Beauv., *Hordeum murinum* (L.), *Hyparrhenia hirta* (L.) Stapf., *Koeleria phleoides* (Vill.) Pers., *Lamarckia aurea* (L.) Moench., *Lolium rigidum* Gaudin., *Trisetaria pumila* (Desf.) Paunero., *Vulpia geniculata* (L.) Link., *Vulpia myuros* (L.) C.C. Gmel.

Conclusions. Knowledge of the botanical composition of pasture grassland in Northern Morocco could be used as the first guide for ecologists and botanists interested in the floristic diversity of these special rangelands.

Poster Presentation

Remote sensing as a tool to assess the spatial cover of pasture grasslands in northern Morocco**Y. Chebli¹, M. Chentouf¹, J.F. Cabaraux², S. El Otmani¹**¹ Regional Center of Agricultural Research of Tangier,
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Question (Aims). Northern Morocco harbors the large-scale oak forests in the country, surrounded by agricultural and grassland mosaics. The mountainous topography and the existing forest vegetation explain the strong predominance of grazing goats. Despite the socio-economic role and the predominance of pastoral activities, especially in Western Rif (Chefchaouen), there is little information about the current land cover mapping of forests and pasture grasslands. Remote sensing to assess spatial cover land has become a central element of existing natural resource management strategies to implement appropriate development policies. The objective of this study was to spatially delineate the forest and pasture grassland based on remote sensing data.

Methods. The available data are an image scene from the operational land imager/ thermal infrared sensor (OLI/TIRS) images, with 30 m of spatial resolution on board of Landsat 8 satellite, on July 18th, 2019. To better describe the LULC change types and to increase the probability that these changes closely reflect the ground reality based on our prior knowledge of land use in the study area, a total of seven major land cover classes were used: forest; pasture grassland under matorral, pasture grassland; grassland mixed with cultivated areas; cropland; built-up area; and water.

Results. Forest, pasture grassland, and cropland cover an area of 39, 3.9, and 3.1%, respectively. The most prominent cover land was recorded by pasture grassland mixed with cropland (51.5%). The land cover results of the forest class agree with the statistics data reported in the official reports, except for the land cover of classes including pasture grasslands, because they have never been studied before.

Conclusions. Overall, this research contributes to knowing Western Rif's current land cover types for future interventions to develop and manage forest and pasture areas.

Oral Presentation

Predicting intraspecific trait variation in mountain grassland communities: do disease and herbivory matter?**Szymon Czyżewski¹, Brody Sandel², Anna-Liisa Laine^{1,3} & Fletcher W. Halliday¹**

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Question (Aims). Can intraspecific trait variation (ITV) be predicted using the local environment and species information? What do the model predictions tell us about how ITV may affect community trait means in changing environments?

Methods. To address these questions, we measured two functional traits, specific leaf area (SLA) and leaf area (LA) on 2221 individuals, belonging to 65 plant species, embedded in 199 communities across a 1101-meter elevational gradient. We used a machine learning algorithm, specifically a random forest, to explore the prospect of predicting ITV from environmental variables, species phylogenetic position, and species characteristics such as moisture preferences and growth forms. To assess the importance of biotic (disease risk, herbivory risk) and abiotic (soil moisture, temperature) environment as well as species phylogenetic position and characteristics for predicting ITV, for each variable we computed the marginal effect of that variable on predictive performance on a testing data set. Finally, we used this random forest model to predict how ITV shifts, driven by simulated changing environments, affect community trait means.

Results. The full random forest model we built was able to accurately predict ITV based on local environment, species phylogenetic position, and species characteristics (SLA $r = 0.901$; LA $r = 0.894$). Most important for the model's predictive performance was the local environment (SLA $r = 0.499$; LA $r = 0.470$). Within the local environment most important were the biotic variables: disease risk (SLA $r = 0.195$; LA $r = 0.198$) and herbivory risk (SLA $r = 0.196$; LA $r = 0.195$) followed by species phylogenetic position (SLA $r = 0.148$; LA $r = 0.150$) and species characteristics (SLA $r = 0.121$; LA $r = 0.117$). SLA and LA ITV changes driven by simulated changes in disease and herbivory risk caused the community means to increase at high and decrease at low risk. ITV changes, driven by simulated temperature and soil moisture changes, affected the community means only for SLA.

Conclusions. These results suggest that ITV can affect community trait patterns and that incorporating herbivory and disease is helpful for predicting ITV under global change.

Poster Presentation

**Creating urban wildflower meadows:
experiment on the effect of abiotic conditions**

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Background. Increasing urbanization induces habitat loss and fragmentation, causing deterioration of natural ecosystems and biodiversity. It is crucial to tackle biodiversity-loss caused by urbanization not only by diminishing the negative influences, but also by seizing the given opportunities. Creating species-rich grasslands in urban environments can increase the biodiversity value, reduce management costs and can increase the amenity value of the city. However, being novel ecosystems on soils with no natural analogue, little is known concerning the ecology and management of these urban grasslands.

Methods. We set up a field experiment with grassland species on rubble grounds in the city of Ghent, Belgium. Situated in the northern part of Belgium, it represents among the regions with the highest degree of urban sprawl in Europe. We have sown a seed mixture consisting of a broad range of species (32 species), selected to cover a gradient in tolerance to drought stress and nutrient limitation. Organic material and phosphorus were added to the rubble ground in a fully crossed experimental design. This allows testing the (interactive) effects of drought and nutrient stress on community development, respectively. The same species were sown across the treatments.

Aim. Over a period of 4 years, we investigate the effects of these contrasting abiotic starting situations on plant species richness, composition, productivity and their influence on aesthetic value. Insights into the ecology of these novel conditions are translated to practice by formulating concrete measures for the creation and management of species-rich grasslands in urban environment, specifically on rubble grounds, taken the amenity value, management cost and biodiversity value into account.

Oral Presentation

Environmental heterogeneity driven plant diversity: the ecological role of small natural features in agricultural landscapes

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Aims. Small natural features (SNFs), such as road verges, midfield islets, rocky outcrops and ancient burial mounds, provide safe havens for species of natural habitats in human-modified landscapes; therefore, their great ecological importance is in contrast to their small size. SNFs often have a high topographical heterogeneity and abiotic conditions, which differ from their surroundings; therefore, they provide a unique opportunity for establishing links between environmental heterogeneity (EH) and biodiversity. However, no study has so far investigated the EH components of topographically heterogeneous SNFs in a comprehensive framework, by linking environmental and biotic parameters. To fill this knowledge gap, we evaluated the EH components and their effect on biodiversity on ancient mounds covered by semi-natural grasslands in the Pannonian (Hungary) and Continental (Bulgaria) biogeographical regions.

Methods. We designated 16 study sites, each containing a few-metre-high mounds with five microsites (top, north-, east-, south- and west-facing slopes) and a nearby plain grassland. At each microsite, we measured soil moisture, soil chemical properties, solar radiation and microclimate; and recorded the cover of vascular plants in a total of 480 plots.

Results. On the mounds, 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.

Conclusions. Various combinations of the EH components resulted in unique plant species compositions within the microsites, and supported the co-occurrence of species typical of contrasting habitat types, even within a couple of metres. By combining high resolution measurements of abiotic factors with fine-scale vegetation sampling, our study provides evidence that widespread SNFs with complex topography harbour several grassland-specialist plant species and introduce a high level of EH to otherwise homogeneous plain landscapes, which cover one third of the global land area.

Poster Presentation

Rapid functional but slow species diversity recovery of steppe vegetation on former arable fields

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Questions (Aims). Temperate grasslands (steppes) are among the most threatened biomes mostly due to the conversion to arable land. Abandonment, as well as land acquisition for the nature conservation purposes may be a chance for their passive restoration. We used exceptional opportunity to study nearly 100 yrs of old-field succession chronosequence located in the southern Ukraine to assess the speed and overall effectiveness of passive steppe restoration. We asked:

- i. Is the vegetation composition, structure as well as its taxonomic, ecological and functional diversity able to self-restore?
- ii. Are the rates of restoration of all these indicators similar?
- iii. Does the vegetation recovery influence soil carbon and nitrogen content?

Methods. We sampled vegetation and soil in a virgin (never ploughed) grass steppe (VS) and in old fields (OFs) abandoned for 6, 15, 31, 50 and ca. 97 yrs. The composition data was subjected to multivariate analysis. To check how far species composition and diversity as well as basic functional and soil characteristics of studied OFs diverge from the VS, a one-way ANOVA with Tukey's HSD statistic and 95% confidence interval approach was used.

Results. Vegetation composition of all but the two oldest OFs differed from the VS while its structural and functional characteristics were significantly different from the VS only in the case of the youngest OF. Species richness and share of steppe habitat specialists were lower than in the VS in all of the OFs but oldest one. We found lower than in the VS contents of $C_{org.}$ and $N_{tot.}$ in OFs abandoned for less than 50 yrs.

Conclusions. Functional and structural characteristics of the steppe vegetation seem to recover much faster than its typical biodiversity. However, 100 yrs can be enough time to self-restore such ecosystem and its carbon stocks, if preserved steppe patches are directly neighbouring the abandoned farmland.

Oral Presentation

Plant invasions in grasslands of Switzerland: invaders, spatial patterns and effects on biodiversity

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Questions. The spread of neophytes is often perceived as a major threat to biodiversity. However, while there is ample evidence on negative effects of neozoa and neomycota on biodiversity, the evidence concerning neophytes is rather mixed and based on local case studies only. We thus asked for the grasslands of Switzerland: (1) How frequent and dominant are neophytes in general and individual neophyte species? (2) Which effect do neophytes have on plot-scale species richness?

Methods. We extracted 8108 10-m² vegetation plots from the three biodiversity monitoring programs of Switzerland, including cover data of all occurring vascular plant species. They represent all regions and grassland types of the country. We used the subset of plots with statistical weights ($n = 2743$; normal landscape) to calculate the average frequency, richness and relative cover of neophytes for Switzerland and for biogeographic regions and elevational belts separately. We then created multiple GLMs to explain plot-scale species richness by main ecological niche dimensions (represented by mean indicator values for temperature, soil moisture, soil pH, nutrients and cutting tolerance) and presence of the 21 neophyte species with at least five occurrences in the full dataset.

Results. We found a total of 42 neophytes in the normal landscape dataset, and 30 more in the full dataset. Most frequent in the normal landscape were *Lolium multiflorum* (20.9% of all plots), followed by *Veronica filiformis* (10.9%), *Veronica persica* (9.4%), *Medicago sativa* (2.1%) and *Erigeron annuus* (1.0%). The richness and cover of neophyte species strongly decreased with elevation. In the multiple GLM, species richness showed highly significant unimodal relationships to all five niche dimensions considered. When adding the neophyte occurrence, six species had a significant negative effect on plot-scale biodiversity (*L. multiflorum*, *M. sativa*, *Bromus inermis*, *Impatiens glandulifera*, *Onobrychis viciifolia*, *Artemisia verlotiorum*), and five a positive one (*V. persica*, *V. filiformis*, *E. annuus*, *Conyza canadensis* aggr., *Solidago gigantea*). When calculating overall impact

on biodiversity by multiplying the plot-scale effect with frequency, the most problematic neophyte was *L. multiflorum*.

Conclusions. With a statistically representative dataset for all grasslands of a whole country we could demonstrate that neophytes are not a widespread phenomenon and only few have negative impacts on plot-scale plant species richness.

Oral Presentation

FlowerPower the garden: experimenting, learning and raising awareness about species-rich grassland in a citizen-science project**Jorunn Dieleman, Stephanie Schelfhout & An De Schrijver**

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Questions. Private gardens offer an important strategic potential for biodiversity, particularly as they cover a larger part of territory than nature reserves (8 vs. 6.5%) in the region of Flanders (Northern Belgium). However, many gardeners still opt for a (bi-) weekly mown not very biodiverse lawn. Various initiatives such as 'ByeByeGrass' and 'No Mow May' urge European citizens to 'let the grass grow' and thereby switch to species-rich grasslands in the garden. We seek to answer:

- What are the barriers and motivators to create a biodiverse lawn?
- Why do or don't we get a species-rich grassland by mowing less frequently?
- How can a gardener contribute to the improvement of biodiversity?

Methods. In October 2021, we held an on-street survey questionnaire with 1700 citizens with gardens to investigate how Flemish citizens manage their lawn and how they perceive a biodiverse lawn. We performed a cluster analyse to understand the barriers and motivators for different types of garden users to create a biodiverse lawn. In December, we launched our citizen science experiment in which citizens experiment with their lawn. From 1,300 candidate citizens, we selected participants spread across Flanders, in urban vs. semi-urban vs. rural areas along a gradient in 'garden score' (a measure for biodiversity based on a questionnaire). In February 2022, 492 citizens set up the experiment in their lawn testing three measures for improving species-richness. They documented the land-use history, evaluated the soil texture and took a soil sample for analyses of soil fertility. In June, the citizens will count flowers per species and register flower-visiting insects. Also sward height (as proxy for biomass) will be measured, just before mowing the vegetation and removing the cuttings. They will repeat these measurements and management in August/September 2022, and in 2023.

Results. The questionnaire revealed a large support base for species-rich grasslands in the garden, but also a lack of knowledge on how to create these biodiverse lawns. We will relate the garden characteristics to the number of flowers and flowering plant species, registered insect visitors, and biomass production.

Poster Presentation

Reassessment of McNaughton's grazing lawn paradigm: a synthesis of functional characteristics shaping grazing ecosystems**Susan E. Eshelman^{1,2,3}, Caroline Lehmann^{1,3}, Graham Stone¹, Sally Archibald⁴, & Gareth Hempson⁴**¹ University of Edinburgh² Royal Botanic Garden Kew³ Royal Botanic Garden Edinburgh⁴ University of the Witwatersrand

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Aims. Through concentrated grazing, herbivores can create and maintain patches of quality forage, called grazing lawns, first described by McNaughton in 1984. McNaughton's definition traditionally applied to tropical C₄ grassland ecosystems with large mammal herbivores. However the identification of grazing lawns in a variety of ecosystems within and outside the tropics indicates that our understanding of grazing lawns may be broader than the current convention. We aim to reassess the paradigm of grazing lawns by assessing the functional aspects of the McNaughton grazing lawn paradigm and determining if these functional aspects, independent of taxonomic descriptors, can be applied more generally across a range of temporal and spatial scales.

Methods. We conducted a literature search and collated case studies that focus on concentrated grazing in a variety of ecological and environmental contexts, assessing the current state of knowledge on grazing lawns and grazing ecosystems. From this, we identified and defined the unifying principles and concepts governing grazing lawns in a global context as well as the gaps within and limitations of these concepts. Lastly, Principal Component Analysis (PCA) of bioclimatic variables was conducted to assess the environmental niche of the case studies.

Results. We identified 108 grazing lawn case studies across six continents and in both terrestrial and aquatic systems. Cases studies also included a wide range on animal and plant taxa. We defined a collection of characteristics that define grazing lawns in the broad sense. Then through meta-analysis of case studies, we determined that grazing lawns can occur across a variety of environmental niches. We found no significant difference between self-identified grazing lawn case studies and those identified using our grazing lawn characteristics.

Conclusions. We found grazing lawns occupy a range of environments and include a variety of plant and animal taxa. The inclusion of taxonomy and environment within the classic grazing lawn concept has led to the exclusion of many case studies and interactions. Therefore we conclude that an updated concept of grazing lawns should be devoid of taxonomy in order to better encapsulate that diversity of landscapes shaped by concentrated grazing maintaining a positive consumer-resource feedback loop.

Poster Presentation

**Butterflies as grassland biodiversity indicators:
the Basque monitoring scheme**

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Aims. Butterflies (Lepidoptera Papilionoidea) are increasingly acknowledged as biodiversity indicators because they fulfill several ideal requirements, including biological and ecological constraints, environmental sensitivity, and public engagement. Data from long-lasting butterfly monitoring schemes are used to build multi-species indicators that inform biodiversity situation and policies. The established European grassland indicator collates data about 17 characteristic grassland butterflies. In the Basque Country, a butterfly monitoring scheme was set in 2008, to assess the trends of regional populations, and also the conservation status of grassland systems.

Methods. Butterfly occurrence and abundance was registered along 1.5-2 km transects by skilled field observers. These were either professionals (park rangers) or amateurs, because a citizen-science approach was applied. Transects were surveyed yearly, once every fortnight during the flying period of adult butterflies, i.e., from April to September. Each transect sampled an homogeneous tracts of habitat. Temporal series were accumulated and subsequently analysed, accounting for missing values, to estimate annual change of the population index for particular species. Trends were then combined for grassland typical species, to produce the indicator.

Results. Around 30 transects were surveyed each year, providing 11.000-22.000 records of 100-130 butterfly species, which makes roughly 80 % of the richness of the group for the Basque Country. Statistical requirements for trend estimation are demanding, so rare and/or scarce species are generally data deficient. During 2010-2022, two grassland species showed declines (*Thymelicus action*, *Anthocharis cardamines*), one was stable (*Maniola jurtina*), two increased (*Lasiommata megera*, *Lycaena phlaeas*) and the rest showed uncertain trends (*Lysandra coridon*, *Ochlodes sylvanus*, *Coenonympha pamphilus*, *Polyommatus icarus*, *Euphydryas aurinia*, *Erynnis tages*, *Cyaniris semiargus*, *Cupido minimus*, *Lysandra bellargus*, *Spialia sertorius*, *Phengaris arion*). The multi-species grassland indicator remained globally stable.

Conclusions. Grassland butterfly species in the Basque Country have shown mixed trends for the last decade, and the multi-species indicator does not suggest noteworthy variations at the regional scale.

Poster Presentation

Morphotaxonomic measurements of *Festuca* taxa of sandy grasslands along the Danube

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Introduction. In botany, the status of *Festuca* taxa has long been a controversial issue that needs to be clarified.

Question (Aims). Based on this, the following research question has been formed: Which *Festuca* species can be found in sand grasslands along the Danube?

Methods. In this study, we collected *Festuca* taxa for morphological measurement to clarify the occurrence of these taxa. *Festuca* specimens were planted in the pilot area of MATE. They were grown under the same conditions. Measurement was carried out with a stereomicroscope.

Results. According to measurements, length of the inflorescence, length of the spikelet, length of the upper glume, length of the lemma and the length of the awn of lemma are useful traits for definition. Based on the results of the measurements, *Festuca vaginata* with short awn or without awn can be found along the Danube from Austria to Romania. In addition, the following species were confirmed from sandy grasslands: *F. pseudovaginata*, *F. javorkae*, *F. wagneri*, *F. tomanii*. *Festuca wagneri* and *F. pseudovaginata* were found as new species in Slovakia, and *Festuca tomanii* was found as a new species in Hungary.

Conclusions. In order to identify exact taxa, more genetic research is necessary. We expect that this method can reveal which taxa are really found.

Acknowledgement. The survey was supported by OTKA K-125423.

Poster Presentation

Assesing the effectiveness of temporal fencing on an endangered population of *Ranunculus amplexicaulis***Daniel García-Magro, Itziar García-Mijangos & Juan Antonio Campos**

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Aims. In the siliceous summit of Mount Gorbeia (Basque Country, northern Spain) relict subalpine communities of mountain grasslands are developed. Traditionally, these pastures were used for extensive livestock farming. Although the pressure on livestock has decreased in recent decades, this use, which is necessary for the conservation of these pastures, is still maintained. Nevertheless, some particular species may be affected by grazing pressure, especially the populations growing in the distribution limit of the species. This is the case of *Ranunculus amplexicaulis*, an endangered species which maintain a relict population at the top of this mountain (above 1300 m.a.s.l.). After observing that livestock consumed the flowers of *Ranunculus amplexicaulis* before fruit formation, we set the objective to analyze the impact of early grazing on the population dynamics of this species.

Methods. We used the BACI (Before After Control Impact) methodology, a sampling design frequently used in environmental impact assessment due to its usefulness in cases where replication of samples is not possible. In 2014, four permanent plots of 100 m² were installed in order to monitor the demography of the species. Since 2016 two plots have been annually fenced during the breeding season (May to July) and the other two have been used as controls. Each plot was divided in 100 subplots of 1 m² and the number of individuals with their phenological stage was counted in each subplot. Additionally, 10 subplots in each plot were randomly selected in order to monitor vegetation changes. Annual census has been conducted since 2014 until 2020.

Results. Despite annual fluctuations, a slight increase of individuals has been observed in the fenced plots. However, these changes were statistically not significant. Regarding vegetation changes, some trends were observed in the fenced plots, where an increase of some *Ericaceae* species and a decrease of *Nardus stricta* occurred.

Conclusions. Temporary fencing has no significative effect in the changes of the *Ranunculus amplexicaulis* population of Mount Gorbeia.

Oral Presentation

Grasslands of Navarre (Spain), focusing on the *Festuco-Brometea*: classification, hierarchical expert system and characterisation

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Aims. During the last decades, great advances on grassland classification have been made in several countries or regions across Europe. However, grasslands of Southern Europe are still not well-known and the distinction of the Mediterranean grasslands from those of temperate Europe is not clear, especially along the submediterranean areas. Our aims were to clarify the syntaxonomic position of grasslands in northern Spain, with special focus on the dry grasslands, and to characterise the resulting syntaxonomic units in terms of diagnostic species and ecological conditions.

Study area. Navarre (northern Spain).

Methods. We sampled 119 plots of 10 m² following the standardised EDGG methodology and analysed them together with 839 plots of similar size recorded in the 1990. For the classification, we used the modified TWINSPLAN algorithm, complemented by the determination of diagnostic species with phi coefficients of association, which led to the creation of an expert system. We conducted these steps in a hierarchical manner for each syntaxonomic rank. We visualised the position of the

syntaxa along environmental gradients by means of NMDS. Species richness, and structural and ecological characteristics of the syntaxa were compared by ANOVAs.

Results. We could clearly identify five phytosociological classes: *Lygeo-Stipetea*, *Festuco-Brometea*, *Molinio-Arrhenatheretea*, *Nardetea strictae*, and *Elyno-Seslerietea*. Within the *Festuco-Brometea* a xeric and a meso-xeric order could be distinguished, with two alliances each, and eight associations in total.

Conclusions. The combination of numerical methods allowed a consistent and more objective classification of grassland types in Navarre than previous approaches. At the association level, we could largely reproduce the units previously described with traditional phytosociological methods. By contrast, at higher syntaxonomic level, our analyses suggest significant modifications. Most importantly, a major part of the units traditionally included in the *Festuco-Ononidetea* seem to fall within the *Festuco-Brometea*. We could show that bryophytes and lichens are core elements of these grasslands and particularly the Mediterranean ones of *Lygeo-Stipetea*, both in terms of biodiversity and of diagnostic species. We conclude that the combination of our different numerical methods is promising for deriving more objective and reproducible delimitations of syntaxa in a hierarchical manner.

Poster Presentation

Secondary seed dispersal by barn owl (*Tyto alba*) extends the dispersal rate of plants in grasslands

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Aims. Seed dispersal is an essential process contributing to maintenance the populations of plant species. Zoochory is a widespread way of plant dispersal in every terrestrial ecosystem that can ensure the long-distance dispersal of seeds. Secondary seed dispersal by far-ranging raptors is a special type of seed dispersal, but might have a major role in colonizing new habitats. We used the barn owl (*Tyto alba*) as model species to test the effectivity and seasonality of SSD in open semi-natural landscapes and the effect of the pellet material on the germination success.

Methods. We collected 600 pellets from five sites in an alkali landscape throughout the year. We identified prey items in the collected pellets. The viable seed content of the pellets we determined by germination experiments.

Results. We recorded 75 individuals of 22 plant species germinating from pellets, which were mostly generalists and disturbant tolerant plant species typical to the grasslands of the study area, but three adventive species were also detected. Presence of prey remains in pots increased seed germination, and enhanced seedling survival and establishment. Average mass of seedlings was also significantly higher if pots contained prey remains.

Conclusions. Our study suggests that secondary seed dispersal by barn owl is an important but stochastic event in grasslands but may have an important role in seed dispersal in fragmented landscapes. We also proved that remains of prey can significantly promote seedling establishment, thus can increase the establishment success of seeds transported by owls.

Oral Presentation

**Diversity versus simplicity:
strong contrast between the butterfly communities of extensive
grassland, intensively used farmland and urban areas**

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Butterflies, as an important ecological indicator and pollinator taxon, require in Europe human interventions to sustain their populations in cultivated landscapes because many species thrive in successional habitats. However, land-use changes and management intensification are currently responsible for their decline.

In this study we compared 93 butterfly communities recorded from seven widely distributed land-use types by analysing species composition, species diversity, and functional traits to assess the effects of land-use. We were particularly interested to see whether grasslands of supposedly high nature-conservation value (HNV) harbour characteristic butterfly assemblages, which would corroborate the effectiveness of related management practices to counteract biodiversity erosion. We recorded a high diversity in HNV grassland (extensive meadows and pastures). All other land-use types showed significantly lower values, with decreasing scores in (semi-) intensive meadows, vineyards, arable lands, settlements and with the lowest scores in intensive apple orchards. Moreover, functional traits uncovered a general trend: extensive grasslands supported communities of more specialized and sessile species whilst all other non-HNV land-use types showed communities characterized by mobile generalists. Hence, we found supporting evidence for the effectiveness of regional Agri-Environmental Measures (AEMs) for butterfly conservation. Community composition was driven by the land-use type and explained by land-use intensity, habitat openness and elevation related variables. Important life-history traits further correlated with site variables confirming the shift from specialists to generalists along increasing land-use intensity gradients and the effect of the thermal environment on phenological traits.

The strategy to focus European conservation schemes at least partly on the preservation of HNV grasslands with extensive management seems to be the most promising measure to promote a diverse butterfly fauna in European cultural landscapes. Furthermore, we clearly show the poor ecological state of butterfly communities in more disturbed land-use types (including urban areas) and propose adopting measures to improve butterflies' conservation status in these environments.

Oral Presentation

Increasing abundance of an invasive C4 grass has greater impact on functional community characteristics away than at home

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Aims. We evaluated the stands of the invasive grass, sand dropseed (*Sporobolus cryptandrus*) in its native North American (Montana, USA) and non-native European (Kiskunság, Hungary) range, where it is a recent invader. Our aim was to reveal how the species' increasing abundance affects functional diversity and ecosystem service provisioning capacities of plant communities in both ranges.

Methods. All vascular plant species and their relative abundances were recorded in a stratified random manner in 1 m × 1 m plots in each range, using the following cover categories of *Sporobolus* as strata: 1-25%, 26-50%, 50-75% and 75-100%. The functional characteristics of the plant communities of the two continents were compared using a trait-based approach.

Results. Increasing *Sporobolus* cover resulted in a lower functional diversity, reduced average specific leaf area and increased height in both ranges but these effects were significantly stronger in the non-native stands. *Sporobolus* also negatively affected the cover of insect-pollinated plant species and the proportion of native perennials, switching the rest of the community from perennial-dominated to annual-dominated.

Conclusions. The spread of *Sporobolus*, away from its native range, leads to the impoverishment of host communities and compromises the biomass and floral resource provisioning capacity of the vegetation to higher trophic levels. Tackling the spread of this new invader should therefore be a priority task.

Oral Presentation

Can we further restore xerothermic grasslands in the southwestern part of Protected Landscape Area České středohoří?**Roman Hamersky¹, Katerina Tremlova¹ & Anna Vetvickova²**

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Aims. Over 500 ha of restored dry grasslands in PLA České středohoří (significant part of 6210 habitat already restored in CZ) is monitored with the aim to maintain habitat quality and quantity. Public involvement and support is needed for habitat restoration process continuation due to public financial sources expenditures.

Methods. Populations of *Stipa zalesskii* ("SZ", the only registered in the EU) and *Helictotrichon desertorum* ("HD", the westernmost population spread limit) are monitored together with other important habitat's key species indicators (ex.: *Stipa div.*, *Astragalus div.*, *Oxytropis pilosa*, *Globularia binagarica*). Botanical relevés at dozens permanent plots (restored and then managed and un-restored) are taken and statistically evaluated. Vegetation changes (dominance, abundance) are observed last 10 years or even several decades at some special plots. Management (ex.: pasture, mowing pressure) is then adapted to the research results and short term climatic conditions forecasts. Public involvement is strengthened thanks to annual organization of special events ("Steppe festivities", "Pasture festivities").

Results. Species abundance detected reaches in max. 60 plant species/25 m² at both restored and un-restored plots. Difference is in key habitat species presence. HD and SZ population abundance rises with higher management pressure (grazing) up to overall coverage of appx. 40 % (higher/lower pasture pressure causes population's decline). Overall key species coverage rises rapidly after habitat restoration and continuous management. Overall visit rate reaches 1 000 participants/event in max.

Conclusions. Unrestored localities are being restored from pre-identified spots with some key species presence left. Restoration enlargement from those spots seems be more effective. Abundance of HD ascends up to thresh point of appx. 40% of overall coverage, than it stagnates / declines. Organisation of special public events seems be the outstanding form of public habitat restoration communication.

Oral Presentation

Livestock grazing and proximity to species-rich sites promote restoration in grasslands**Rozália Kapás, Adam Kimberley, Sara Cousins**

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Question (Aims). In recent years, restoration on former grassland sites has been widely applied in Sweden, aiming to address the historical loss of ancient species-rich grasslands. When restoration of former grasslands occur, species may slowly establish from belowground seed bank and from surrounding landscape. However, using remnant habitats in nearby landscape and traditional grazing can be a cost-effective tool to facilitate the colonization of grassland species from the different seed sources and hence to improve species richness and composition of degraded and restored grasslands. In this study, we aimed to investigate how management, distance to source populations, spatial dispersal, local abiotic conditions affect species establishment on restored grasslands and which groups of species contributed to grassland colonization over time.

Methods. We surveyed plant communities on grassland sites to assess how differing local management history, abiotic conditions, and potential for spatial dispersal from nearby source populations influence species richness and composition in the vegetation and seed bank communities of restored grasslands.

Results. We found that the presence of grazing animals and distance to adjacent species-rich grasslands increased the number of the species on restored grasslands in both the vegetation and seed bank. Plant species associated with forest habitats declined from the restored areas, while the occurrence of generalist species together with grassland specialists generally increased in the vegetation. Whereas, more species were present in the seed bank, where grazing was active compared to non-grazed sites. However, the overall colonization pattern was not consistent over time and specialist species presence were rather scattered on restored sites in the vegetation.

Conclusions. The observed patterns highlight that spatial dispersal and disturbances mediated by animals can facilitate the colonization of grassland species on restored sites. However, our results suggest that successful colonization of grassland species takes place gradually and benefits from species-rich sites together with grazing management adjacent to the restoration targets. Therefore, a continued functional connectivity provided by livestock grazing among species-rich and restored sites is necessary to improve the diversity of the restored grasslands and to ensure the seed dispersal and establishment of grassland specialists in vegetation and accumulation in seed bank.

Poster Presentation

How do the plant traits and the grazing intensity affect the quantitative and qualitative components of facilitation?

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Question. Unpalatable species may provide a protection against grazing that outweighs their competitive effects and shifts the plant-plant interactions towards the facilitative direction. Functional traits of interacting species jointly with the grazing intensity may essentially affect facilitation. Quantitative component of the outcome of facilitation refers to the biomass production, while qualitative component refers to the flowering performance of subordinate species. We hypothesized that (i) in the case of quantitative component depends on the life form of the facilitator (shrub vs. graminoid) only at high grazing intensity, (ii) but in case of the qualitative components the importance of facilitation depends on the life form of the facilitator also at the low grazing intensity.

Methods. We studied species-rich meadow steppes with different grazing intensities: (i) non-grazed, (ii) low, and (iii) medium grazing intensity. We have two replicates from each grazing intensities. We studied the facilitative effects of three small-sized shrub and three graminoid species. In each site, five above-ground biomass sample pairs were collected from the interior of facilitator species and from the neighbouring open vegetation. Dry weights of the litter and the green biomass of vascular plants were measured. During the statistical analyses we revealed the importance of facilitation using relative response indices and linearized mixed effect models.

Results. According to our hypotheses we detected stronger facilitative effects of shrubs compared with the graminoids at medium grazing intensity and there was no difference between their effects at low grazing intensity. In the case of flowering success, we detected stronger facilitative effect of shrubs both at low and medium grazing intensity.

Conclusions. The protective effect of graminoids decline at the medium grazing intensity, because of the destruction of their stems, contrary the protective effect of woody plants still persists in pastures characterized by higher grazing intensity. Our study confirms that the occurrence of small-sized unpalatable plants in pastures can support a lot of subordinate species, and sparse population of unpalatable plants contribute to formation of a desirable micro-mosaic structure of the vegetation.

Oral Presentation

Timing seed-sowing properly facilitates restoration of species-rich grasslands

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The restoration and rehabilitation of degraded grasslands is increasingly important as we have entered to the UN Decade of Ecosystem Restoration. Grassland restoration can be a feasible option in marginal, abandoned croplands where restored grasslands can provide important ecosystem functions and support the grassland related plant and animal species. Sowing of low- diversity seed-mixtures is adequate to restore species-poor grasslands in large areas, while high-diversity seed-mixtures are frequently used methods to restore species-rich grasslands. When applying both, the timing of seed-mixtures sowing is essential.

Aims. In our study we aimed to identify the most efficient timing of seed-mixture sowing to maximize establishment success of sown forb species and so, to maximize the diversity of the sown grassland. We also aimed to minimize the establishment success of weeds.

Methods. We applied grass-seeds, diverse forb seed-mixture and the combination of the two in a recently abandoned cropland. Grass-seeds were sown in the first year of the experiment. Forb seed-mixture was sown simultaneously or 1, 2 or 3 years after the sowing of grass-seeds, in plots previously sown with grass-seeds or in empty plots (fallow).

Results. The results highlight the efficiency of both grass-seeds and forb seed-mixture in covering bare soil and suppressing weeds. Sown forbs performed better when sown in fallows, especially in younger ones. Forb seed-mixture sowing combined with grass-seeds was effective only in simultaneous sowing or with one-year delay. Later introduction of forbs was less successful, and can be costly in practice, as it needs the severe disturbance of the existing vegetation.

Conclusion. Based on our results, we recommend starting the restoration of species-rich grasslands shortly after cropland abandonment and the introducing the target species simultaneously to the area.

Poster Presentation

**Habitat use of the European roller (*Coracias garrulus*)
through the full annual cycle****Orsolya Kiss¹, Béla Tokody²**¹ University of Szeged, Faculty of Agriculture, 6800, Hódmezővásárhely, Andrásy u. 15² BirdLife Hungary, 1121, Budapest, Költő u. 21

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Aims. Majority of migratory birds have declined worldwide which is partially caused by habitat changes. Full annual cycle approach is necessary to understand the processes driving these changes as migratory species use different areas during the breeding and the non-breeding season. The European roller is a migratory bird, which typical species of farmlands and grasslands and its entire European population has undergone a serious decline, except from a few countries with current positive trends, it is still decreasing nowadays. This species is also a long-distance migrant spending the non-breeding period in Africa. Our aim was to study rollers' habitat use during breeding season and also on the stopover and wintering sites.

Methods. The study was performed between 2015 and 2021, our study sites in Hungary were located in the northern and the southern region of the Hungarian Great Plain. Both study sites were habitat reconstruction sites of the ROLLER-LIFE LIFE+ project. To achieve high spatial precision, ECOTONE Pica UHF logger were used for the home-range studies during the breeding period. Microwave PTT's were used to follow rollers' movements during the non-breeding season.

Results. Our results showed high individual variability of home-range size during the breeding period. We found the Sahel region as an important stopover area although we found the highest use of croplands there, contrary to the wintering areas which were mostly characterized by natural grassland vegetations.

Conclusions. Our results contribute to the better understanding of the movements and habitat requirements of the species during the full annual cycle, which is crucial to design the effective conservation measures for the European roller.

Poster Presentation

ExGraze: The effects of long-term grazing exclusion on carbon sequestration and soil carbon storage in grasslands

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Context and aims. Rangelands and native grasslands in Iceland have been used for extensive livestock grazing since the settlement for more than 1000 years ago. Although extensive areas are still used for extensive grazing, these pastoral systems are under similar threats as other grasslands in Europe; from land use abandonment, shrub encroachment and not at least afforestation for climate mitigation. In recent years, however, interest in the possible role of grasslands for climate mitigation has increased as well as the role of grazing animals there within. The aim of our research is to analyse the long-term effect of grazing and grazing exclusion on carbon balance in Icelandic native grasslands. For this, we will compare carbon sequestration, measured as NEE and soil organic carbon content in the whole soil profile in parallel grazed vs non-grazed enclosures with known history. From these results, we aim to evaluate whether Icelandic grazed grasslands can act as carbon sinks and better understand the interaction of herbivores with aboveground and belowground parts of the ecosystem.

Methods. Data will be collected from 40 sampling sites at farms distributed around the whole of Iceland consisting of long-term grazing exclusion (~50 years), and continued grazing in various levels of grazing intensity adjacent to one another. In two field seasons, we will measure CO₂ fluxes and NDVI in the different enclosures during the growth season. Soil samples will be taken from two profiles in each enclosure, down to 60+ cm depth, for analyses of carbon stocks. Other ecosystem functions, like soil decomposition rate, will be recorded.

Results and conclusion. Our data collection will take place in the summer of 2022 and 2023. We will present preliminary results from the first field season (20 sites) and discuss these in relation to the objectives of the project; our research approach; our theoretical framework, as well as the land use changes that are taking place in Iceland today.

Poster Presentation

**Semi-natural grasslands on the dumps of overburden rocks
in Kryvyi Rih Iron-ore Basin (Central Ukraine)****Olga Krasova¹, Liudmyla Lysohor², Anatolii Pavlenko¹**¹ Kryvyi Rih Botanical Garden of the National Academy of Sciences of Ukraine Kryvyi Rih, Ukraine² Kryvyi Rih State Pedagogical University, Kryvyi Rih, Ukraine

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Question (Aims). Mining of iron ore has been going on for 140 years on the territory of the Kryvyi Rih iron ore basin (Kryvbas). More than 100 the dumps of overburden rocks are located indirectly in the city of Kryvyi Rih. The proportion of their reclamation due to the lack of financing is less than 1% of the number of damaged lands. Spontaneous revegetation of the destroyed land is the basic role in improving the environmental condition. The goal of the researches is to reveal the specifics of the spontaneous formation of vegetation cover on ore dumps.

Methods. Eighty phytosociological relevés were made according to the standard Braun-Blanquet method (1964). On each plot, 25 m².

Results. The main factors that influence on forming vegetation of dumps are relief and physical and chemical properties of the overburden rocks. The mosaic structure of ecotypes determines the detailed contour of the vegetation. Among ruderal vegetation of the classes *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951 та *Robinietaea* Jurko ex Hadač et Sofron 1980 are formation of the centers with vegetation, which similar to zonal steppe plants communities, but with a simplistic floristic composition. The largest territories are occupied by the cenoses by *Koeleria cristata* (L.) Pers.; somewhat smaller – *Festuca valesiaca* Gaudin, *Stipa capillata* L., *S. lessingiana* Trin. et Rupr., *Galatella villosa* (L.) Rchb. f. Favorable conditions for the formation of as close to natural vegetation as possible are created on flat surfaces of old dumps (60-130 years), filling of rocks mix and clay loam soil. Such cenoses are identified on the slopes of 130-year-old dumps in the southern part of Kryvbas. The clay loam slopes occupy xerophyte with predominance *Agropyron pectinatum* (Bieb) Beauv. and *Kochia prostrata* (L.) Schrad.; limestone – with dominance of *Jurinea brachycephala* Klokov and *Convolvulus lineatus* L.

Conclusions. Slopes, especially the southern exposition, are characterized by extreme conditions: large areas of them do not grow for decades. Better adapted to existences on this condition of shrubs and tree vegetation. Spontaneous formation of grass communities similar with natural steppe communities, on iron-ore dumps starts a few decades after their delivery is filling.

Poster Presentation

Representation of species of international and national protection in grassland habitats of Ukraine

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Question. To determine the proportion of species with international and national protection status in grassland habitats of Ukraine.

Methods. Data for the study were 23,746 relevés from four phytosociological databases (GIVD codes - EU-00-030, EU-UA-001, EU-UA-005, EU-UA-009). These relevés were analyzed using the EUNIS-ESy expert system and the units obtained were verified. As a result, 30 habitat types belonging to the R (grasslands) group were obtained. Rare species included the species listed in the current edition of the Red Book of Ukraine (241 species), Resolution 6 of the Berne Convention (28 species), Annexes II and IV of the Habitat Directive (16 species) and the IUCN Red List, categories VU, EN, CR (14 species) – 255 species in total. The representativeness of rare species was determined with the participation of plots in which at least one protected species is present in different units (habitat types).

Results. The largest share of plots with protected species was found for arctic-alpine calcareous grassland (R44) and continental dry rocky steppic grassland and dwarf scrub on chalk outcrops (R15), where almost all available relevés (98.4 and 98.0%, respectively) contain protected species. They are slightly inferior to the true steppes (R1B). The smallest number of plots with protected species was observed for halophytic habitats, in particular semi desert salt pan (R64) and continental inland salt steppe (R62). The widest amplitude has *Gymnadenia conopsea*, which occurs in plots belonging to 13 habitat types, *Stipa capillata* (12 types), *Colchicum autumnale* and *Gladiolus imbricatus* (11 types each). Instead, 73 species occur within only one habitat type.

Conclusions. Habitats characterized by the highest participation of protected species (R44, R15, R1B) should be a priority in the development of conservation measures, in particular in the development of management plans for protected areas. The presence of species in a large number of different habitat types indicates the need to analyze the feasibility of their inclusion in the red lists.

Oral Presentation

**Small-scale effects of wild boar rooting activities
in Mediterranean dry grasslands****Rocco Labadessa¹ & Leonardo Ancillotto²**

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Aims. Wild boar rooting activity is well known to cause severe soil perturbation and impacts on plant communities. The assessment of these effects is crucial in the case of grassland vegetation or species of conservation concern. Here, we compare small-scale vegetation data from disturbed and undisturbed grassland sites to evaluate the early-stage dynamics due to wild boar rooting in Mediterranean calcareous grasslands of conservation concern.

Methods. Plant species cover was sampled in grassland sites affected by recent wild boar rooting and in their adjacent undisturbed sites, in Alta Murgia (Italy). Within each pair of disturbed vs. undisturbed vegetation plots, we used the Relative Response Index (RRI) to quantify the change in plant species cover and community parameters (structure, richness, diversity, life forms and Ellenberg's bioecological indices). Paired T-tests were used to find significant differences between disturbed and undisturbed vegetation sets. Multivariate ordination techniques were used to identify shifts in plant community structure.

Results. Despite the strong increase in bare soil, reflecting a significant decrease in vegetation cover, overall species richness and diversity values did not change after wild boar disturbance. Disturbed sites show significantly higher cover of therophytes and lower cover of hemicryptophytes, as well as a decrease in characteristic species of perennial grasslands. Changes in differential species of annual and ruderal communities were not significant. At community level, disturbed plots differed from undisturbed ones, yet with very limited changes, mainly due to an increase in Asteraceae, Lamiaceae and Brassicaceae, and a decrease in Apiaceae, Euphorbiaceae and Orchidaceae.

Conclusions. Our results enable to reconsider the expected impact of wild boar on local grasslands, showing overall minor changes in plant communities even at an early successional stage after rooting activities. Locally, grassland degradation was possibly mitigated by the moderate extent of wild boar rooting and by the continuity and good conservation status of surrounding grasslands. In this regard, grassland diversity may even benefit from scattered and low-frequency perturbation due to wild boars, which tends to enable annual forb plant renovation and habitat heterogeneity at patch scale.

Oral Presentation

Habitat specialist species drive fine-scale diversity-area relationships (DARs) in southern European Atlantic coastal dunes**Diego Liendo, Idoia Biurrun, Juan Antonio Campos & Itziar García-Mijangos**Department of Plant Biology and Ecology,
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Question (Aims). Species-area relationships have traditionally focused on species richness only. However, other diversity components, such as phylogenetic diversity, can provide additional information that may help understand how biodiversity patterns change across spatial scales, but only recently has phylogenetic information been included in the study of species-area relationships. In the present study, fine-scale vascular plant composition was sampled in nested plots of seven different sizes (0.0001-100 m²) on southern European Atlantic coastal dune communities (embryo, mobile and fixed dunes) in order to analyse diversity-area relationships. These were analysed separately for the whole species pool (total species) and for the subset of specialist species.

Methods. Diversity indices included taxonomic diversity (TD, by means of species richness), Faith's index of phylogenetic diversity (PD) and the standardised effect sizes of PD (PD.SES) to remove the influence of species richness on PD. A phylogenetic tree was assembled for the calculation of these phylogenetic indices. Additionally, z-values were calculated for TD, PD and PD.SES using linear regressions of the power-law function in double log space.

Results. Preliminary results indicate that TD and PD curves increased with plot size in the three habitats, with fixed dunes accumulating more TD and PD, followed by mobile and embryo dunes. Regarding PD.SES curves, both embryo and mobile dunes had mean positive values at all plot sizes and their curves showed a similar pattern, while PD.SES values in fixed dunes turned from negative at the smallest plot sizes to positive at the biggest ones, peaking at the biggest size of 100 m². Results were similar for total species and for the subset of specialist species, which suggests that the latter drive diversity-area relationships in these coastal dunes. Finally, mean z-values for TD and PD ranged from 0.16 to 0.25 and increased from embryo to mobile to fixed dunes, with higher values for total species in the case of TD and similar values for total species and specialists regarding PD. In relation to PD.SES, mean z-values were close to 0 and negative in embryo and mobile dunes and close to 0 and positive in fixed dunes, both for total species and specialists.

Oral Presentation

**Human-vectored seed dispersal:
A potential threat to the flora of protected areas**

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Seed dispersal vectors can transport the seeds over long distances. One of the most mobile and globally most abundant seed dispersal vectors are us, humans. There are several studies that highlight environmental problems caused by the human-vectored seed dispersal (HVD) and establishment of seeds in the isolated habitats such as Antarctica or Australia. So far, seeds of 449 species have been documented to be able to spread on clothing worldwide.

In a multi-site field experiment we collected propagules from socks and shoes from volunteer participants who were mainly field biologists working in dry grasslands. In the analyses we used variables related to the movement of people, their clothing and the visited habitats. A total of 250 samples (and 2008 subsamples) were collected from 87 people in Hungary, Romania and the Czech Republic. We have identified 228 species of 35935 propagules. We also conducted a questionnaire survey, which showed that most people already clean their footwear from diaspores in the field, while others prefer to leave these propagules in their footwear. According to our results, HVD can support the dispersal of many plant species, especially disturbance-tolerants and weeds in Central-European grasslands. Individual factors play an important role in this process, as in many cases it is up to our decisions to what extent we disperse these propagules from one habitat to another. Therefore, it is very important to minimize the chances of these species spreading in the nature reserves. Furthermore, it is essential to keep visitors properly informed about this phenomenon.

Oral Presentation

Estimation of dark diversity in Austrian grasslands: possibilities and limits of the “biological” approach by using EIV**Martin Magnes & Sina Maria Knappinger**Department of Plant Sciences, Institute of Biology,
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Question. Could the selection of species within the regional flora based on similar Ellenberg indicator values (EIV) for light, temperature, nutrients and moisture (L, T, N, F) to plant species documented in 10 m² plots recorded from the given area deliver reliable estimation of local Dark Diversity (DD)? Are the results indicative for modification in grassland management in order to increase biodiversity?

Methods. We prepared a list of all vascular plants documented in the region and used a modified R-script (Lewis & al. 2016) to detect species with EIV for L, T, N and F values similar to the mean values of 132 analysed plots of traditionally managed grasslands near Neumarkt (Steiermark, Austria). From species with a calculated similarity to the plots but that could not be documented on more than 90 of the 132 investigated plots we studied a set of plant traits to figure out the reasons for their absence.

Results: In total 549 species documented in the region and are concerning L, T, N and F values similar to the mean values of the documented species in the plots were absent in our relevés. 62 species were missing in more than 90 of 132 plots. DD species are generally flowering after the first grassland cut, growing not higher than 60 cm and zoochory is not so common as in the set of documented species. An apparently interesting finding was the much higher DD in the plots with species rich grasslands on relatively poor soils: it can be explained by the flora: more than 70% of the species show N lower than 6.

Conclusion. Although there are many more factors influencing the competition of species in semi-natural grasslands, the method provides good information for a more efficient selection of species for seed-mixtures for renaturation and it could also show plots that are threatened from invasive neophytes already present in the regional flora, especially in case of a changing management.

Poster Presentation

***Themeda triandra* as a grain crop in south-eastern Australia:
a review of agronomic possibilities and constraints,
and future research needs**

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Methods. This paper is a critical review of literature.

Question (Aims). *Themeda triandra* (Forssk.), commonly known as kangaroo grass in Australia, is a warm season C4 perennial tussock grass belonging to the Poaceae family. In Australia, it is a naturally prominent species in temperate and sub-humid grasslands in south-eastern regions of the continent and a component of grasslands in tropical and sub-tropical regions, as well as the semi-arid interior and sub-alpine regions. Today, native grassland communities where *T. triandra* was once prominent are some of the most poorly conserved and degraded vegetation communities in Australia. *T. triandra* is a culturally significant food plant for Aboriginal groups such as Djaara, the Traditional Owner Group representing the Dja Dja Wurrung People of central Victoria. This critical review aims to support the vision of Djaara to develop *T. triandra* in south-eastern Australia into a modern-day perennial grain crop by summarising the genetic, environmental and management factors that affect plant growth and development and seed yield. The review aims to address the questions: **i)** what are the possibilities and constraints in the production of *T. triandra* as a modern-day perennial grain crop and **ii)** what are the recommendations for future research that will help support its success?

Results and conclusions. The review found that there are many constraints to the production of *T. triandra* in its development as a modern-day perennial grain crop, including seed cleaning, harvesting, low seed quality and crop management. The review also highlighted the possibilities of *T. triandra* as a modern-day perennial grain crop, including that it is a relatively low input crop once established, its production of high value seed, and its contributions towards land regeneration, protection of biodiversity and vision of Aboriginal groups such as Djaara. The review provided recommendations for future research, including research aimed at improving sowing and harvest methodologies and better understanding factors that influence seed viability and yield.

Oral Presentation

Plant & vegetation responses to soil phosphorus along a grassland restoration trajectory**Iris Moeneclae^{1,3}, Stephanie Schelfhout¹, Margot Vanhellemont², Eva DeCock¹, Frieke Van Coillie³, Kris Verheyen¹ & Lander Baeten¹**¹ Forest & Nature Lab, Department of Environment,

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Background and aim. Excess soil phosphorus constrains the ecological restoration of species-rich grasslands on post-agricultural land in Western-Europe. At high soil phosphorus availability, slow-growing species (often the restoration target) are at a disadvantage because they are outcompeted by fast-growing species. Gaining insight into the responses of plant species with different ecological strategies to soil phosphorus will help understanding restoration trajectories of grassland ecosystems.

Methods. We set up a pot experiment mimicking grassland communities on a restoration trajectory. We selected twenty species of *Arrhenaterion* meadows with contrasting growth forms (grasses versus forbs) and nutrient use strategies (acquisitive versus conservative nutrient use). We grew monocultures and four-species mixtures along a gradient of soil phosphorus availability and measured the aboveground biomass, vegetation phosphorus content, leaf traits (specific leaf area and leaf dry matter content) and vegetation spectra.

Results. We found a limited, counterintuitive biomass response towards the soil phosphorus gradient: only mixtures with a conservative nutrient use strategy showed a biomass response to increased soil phosphorus supply. The vegetation phosphorus content and leaf trait expression varied considerably between and among species and depended both on the species characteristics (growth form and nutrient use strategy) and the environmental context in which the species was growing (soil phosphorus availability and the vegetation biomass). We also observed considerable variation in vegetation reflectance, mostly linked to between-species differences. Pronounced absorption features for vegetation phosphorus content across the reflectance spectrum were absent.

Conclusion. The species varied greatly in their responses towards soil phosphorus availability. The growth form and the nutrient use strategy significantly contributed to this variation. Vegetation reflectance was mainly explained by species identity, complicating the use of remote sensing for detecting phosphorus limitation in multispecies communities. Our results suggest that under specific conditions (i.e. nitrogen limitation, no dispersal limitation, no light limitation), slow-growing species can survive and even thrive under excess soil phosphorus availability. In the field, competition by fast-growing species may be reduced by increased mowing or grazing management.

Oral Presentation

Grassland change and its drivers as perceived by herders in Hungary, Mongolia and Iran**Zsolt Molnár¹, Batdelger Gantuya^{2,3}, A. Sharifian & Marianna Biró¹**¹ Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary² Botanic Garden and Research Institute, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia³ Eötvös Lorand University, Doctoral School of Biology, Budapest, Hungary

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Vegetation dynamics of grasslands is driven by diverse drivers. Land users, for example, traditional herders and pastoralists are often responsible for these changes. On the other side, they often work on to prevent adverse changes on their grasslands.

We worked with knowledgeable herders in three regions, Hortobágy National Park in Hungary, Khangai and Mörön regions in Mongolia and Turkeman herders in Northern Iran, to learn about how they perceive changes of grasslands and their drivers. Indicators of change, and the role of herders in driving or preventing changes were also studied. We made semi-structured interviews and conducted participatory observations.

Herders perceived degradation, regeneration and also stability of grasslands, often depending on habitat type and position in the landscape. They also observed various impacts of abandonment and overuse. Herders used more than 30 types of indicators to describe observed multi-decadal trends, successional and regenerative cycles, and weather-induced fluctuations. Key drivers attributed to these changes were increasing (or decreasing) livestock numbers, increase of free ranging (instead of close herding), climate change (e.g. changing amount and distribution of precipitation), decrease of available pasture area (e.g. caused by encroachment of other land uses, like arable farming, and neighbours), changing lifestyles (e.g. use of motorcycles, mobile phones) and adverse effects of policies (e.g. inappropriate top-down regulations or lack of proper regulations).

Herders shared their understanding on some possible solutions, for example, developing more adequate regulations, increasing collaboration and knowledge co-production with conservationists and rangeland experts, and improving cooperation between herders to organize grazing at various spatial scales especially in drought and extreme cold situations.

We argue that traditional ecological knowledge of herders can deepen our understanding of grassland change by providing deeper insight into the local interaction and specific impacts of drivers and may help develop locally better adapted policies and regulations to cope more successfully with adverse changes.

Poster Presentation

The flora continuity hypothesis: could most of the species of Carpatho-Pannonian region survive the last glacial maximum?

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Question (Aims). The traditional hypothesis about the Quaternary ecological and evolutionary history of Central Europe has been that ecosystems became repeatedly impoverished due to the extinction of most species during the glacials, followed by massive recolonizations from southern and eastern refugia in the interglacials. Here we provide an alternative hypothesis, which contradicts this traditional postglacial recolonisation hypothesis based on a review of recent literature and our analyses.

Methods. We reviewed the paleoclimatic, genetic and palynological literature from the Carpatho-Pannonian region, and estimated the potential overlap of the native Hungarian flora of the Last Glacial Maximum (LGM) and with the present flora. We used a proxy-based approach: if a native species of the Hungarian flora occurs today in an area in Europe or Northern Eurasia that is as cold or colder than the LGM in Hungary (<+3.5°C mean annual temperature), we can not rule out its LGM survival in the territory of Hungary.

Results. We argue that not only the species already evidenced in the literature but most of the present-day native flora (ca. three-quarter of it) could have survived during and since the Last Glacial Maximum. Our new Flora Continuity Hypothesis argues that long-term and massive flora continuity is more dominant than postglacial recolonization in the Carpatho-Pannonian region.

Conclusions. The long-term continuity of local floras may have fundamental implications not only on biogeographical and ecological understanding (e.g. the temporal scale of processes), but also on conservation strategies (strengthened need to protect ancient, species-rich ecosystems and local gene pools).

Poster Presentation

The nature conservation significance of cultural heritage sites and the need for their integrated preservation

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Given the extremely high level of anthropogenic transformation of the flora, the role of the phytodiversity preservation on small objects, including cultural heritage sites, is growing. We study the role of kurgans (Sudnik-Wójcikowska and Moysiienko, 2012), ancient settlements (Moysiienko *et al.*, 2019; Dayneko *et al.*, 2020), old cemeteries (Moysiienko *et al.*, 2021; Skobel *et al.*, 2022) and old parks (Khodosovtsev *et al.*, 2019) in the biodiversity conservation. In total, more than 200 objects in the steppe and forest-steppe zones of Ukraine have been studied. Most of our research was concentrated in the Lower Dnipro region, within the Kherson Oblast. There are about 1,000 unploughed kurgans, ancient settlements, old parks and cemeteries in the Lower Dnipro region. We studied the vast majority of ancient settlements and old parks, and about 10% of old cemeteries, and nearly 5% of unploughed kurgans located in the region. We selected 75 objects for further analysis and comparison. In total, 796 vascular plant species were found on 26 kurgans, 18 ancient settlements, 10 old cemeteries and 21 old parks, which constitutes about 50% of the flora of the Kherson Oblast, 39.3% of the flora of the Northern Black Sea and 18 % of flora of Ukraine. Among them, the significant shares of non-synatropic, steppe and rare plant species were noted. In further research plan to explore ancient defensive earth ramparts. So far, we conducted only reconnaissance of such objects, which indicated that they show a high nature protection potential. Given that hundreds of kilometers of ancient ramparts have been preserved in Ukraine (Zmiev and Troian ancient ramparts, the ramparts of Bilskogo, Nemyrivskogo, Khotivskogo and others), we assume their significant role in biodiversity conservation. It is apparent that all types of objects we consider are located also in other regions of Ukraine, which implies that the contribution of cultural heritage sites to biodiversity conservation is of great importance. Most of these sites already have a conservation status, but it is aimed at preserving only the cultural component of these sites. This is due to the fact that the cultural heritage sites are poorly studied in regard to their natural values, and therefore their nature conservation significance is little known. Recognising the nature conservation status of cultural heritage sites will help preserve them as a whole. This raises the importance of integrated preservation of nature and culture in cultural heritage sites, which are of high environmental value.

Oral Presentation

Grasslands and coastal habitats of Southern Ukraine: First results from the 15th EDGG Field Workshop

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Question (Aims). The 15th EDGG Field Workshop took place from 24 May to 3 June 2021 in Southern Ukraine (Kherson and Mykolaiv administrative regions). We sampled grasslands and saline habitats in order to improve the classification of grasslands in Ukraine, refine the European vegetation classification, and reveal the patterns and drivers of plant diversity on the regional and continental scales.

Methods. Over 10 days, we sampled different types of grasslands, mainly focusing on steppic, sandy and saline dry grasslands but also taking into account other open habitats, such as mesic grasslands and dunes. In total, we sampled 50 nested-plot series with 7-8 grain sizes from 1 cm² to 100 m² and, in some cases, up to 1,000 m², plus 74 additional normal plots of 10 m².

Results. We can preliminarily assign the sampled plots to seven vegetation classes (*Festuco-Brometea*, *Festuco-Puccinellietea*, *Juncetea maritimi*, *Koelerio-Corynepherea canescentis*, *Cakiletea maritimae*, *Ammophiletea*, *Molinio-Arrhenatheretea*). Mean total species richness increased from 2.6 species in the smallest grain size (1 cm²) to 56.8 species in the largest grain size (1,000 m²). When our results were compared to those from previous EDGG FWs, we found generally lower mean richness values, especially in the larger grain sizes. The richest plot at 1,000 m² was located in a desert steppe (complete vegetation: 84 species; vascular plants: 78 species), at 100 m², 10 m² and 1 m² – in a bunch-grass steppe (complete vegetation: 80, 59 and 42 species respectively; vascular plants: 69, 50 and 35 species respectively).

Conclusions. The initial results of the 15th EDGG FW in Southern Ukraine are very promising, including the new floristic findings and a new world record for the number of species at the grain size 0.0001 m². We sampled 50 nested-plot series and 74 additional normal plots of 10 m² which can be classified into seven vegetation classes. Interestingly, the high-quality biodiversity data of dry grasslands in Southern Ukraine show much lower richness across all scales, especially for the bigger grain sizes. However, at the same time, we had relatively high maximal richness values for the lower grain sizes compared to other regions in Europe.

Poster Presentation

Compliance of the grasslands classification after the application of two methods: standard observation and metabarcoding with ITS2, psAtrnH and trnFL regions**A. Nowak, S. Świerszcz, A. Rucińska, S. Nowak, M. Nobis**

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Question. How the missing species of grasslands identified by molecular methods belowground affect the classification of meadows?

Location. SW Poland, Central Europe.

Methods. To check what is the limitation of conventional surveys in vegetation classification we examined by DNA metabarcoding three different grasslands in south-western Poland in gradients of humidity (wet, *Calthion palustris*; moderately wet, *Arrhenatherion elatioris* and dry, *Bromion erecti*) and management regimes (abandoned, mowed twice a year and 3-4 times a year with trampling). In each area, we selected six 0.9 m² plots in two transects (altogether 54 plots). The eDNA was extracted from a large volume (6 g) of total aboveground and belowground plant organs. To identify the taxa abundance in each plot, two regions of chloroplast DNA (plastid trnH-psbA intergenic spacer and trnL-trnF intergenic spacer) and one nuclear (a segment of an internal transcribed spacer - ITS2) were amplified and sequenced on an Illumina MiniSeq. The classification comparisons were conducted in Juice by comparing synoptic tables prepared with the same parameters (fidelity index and total inertia as the measure of dissimilarity). We used a robust classification into three main humidity types and then additionally for nine clusters representing the grassland type and management regime.

Results. Recently it was found out, that the difference in species richness may reach up to 66% in conventional vegetation surveys and to about 25% when species are identified by eDNA-derived methods both above- and belowground. The comparisons showed that the classification based on standard observational data does not differ from the classification with the use of molecular methods at both levels of division (3 and 9 clusters). The compliance level to the observational data was highest for ITS region region when 3 clusters were compared (79.5%) and lowest for psbA-trnH intergenic spacer for the comparisons of 9 clusters (31.7%). The dendrograms for three clusters have almost the same layout in all data sets, however for the 9 cluster division, the most different was for trnH-psbA region psbA-trnH.

Conclusion. We proved that conventional vegetation surveys conducted by field botanists are still the method of choice for vegetation classification. However, the diagnostic species sets are prone to bias and have considerable differences.

Poster Presentation

Effect of multispecies grasslands on soil microbial community and the relationship with dissolved organic carbon**Omotola Odetayo^{1,2}, **Cornelia Grace**², **Jean Kennedy**², **Ron de Goede**¹ & **Ellis Hoffland**¹**¹ Wageningen University and Research² Devenish Research Development and Innovation

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Background. Increased plant diversity in grassland systems have shown to alter soil microbial community (Lange et al., 2014). However, the interactions between multispecies grasslands and soil microbes are mediated by many factors. In addition to aboveground and belowground litter input, soluble organic molecules, such as dissolved organic carbon (DOC) also play a key role in shaping the soil microbial community.

Aims. The aim of this study was to investigate how three multispecies grasslands at different levels of species richness affect the soil microbial community composition and to assess the relationship between DOC and the soil microbial community.

Methods. The grassland experiment was established in Dowth, county Meath, Republic of Ireland. The three grassland communities studied are: six-species mixture, twelve-species mixture and highly species-rich existing permanent pasture. A monoculture of perennial ryegrass was also included in the treatment as reference. All the four grasslands communities were established on four replicated blocks (n = 16) in a randomized complete block design. At the end of the first growing season, composite soil samples in 0-10 cm layer was collected and analysed to determine the soil microbial community composition using PLFA analysis. Dissolved organic carbon concentration was determined by extracting soil sample with 0.01M of CaCl₂.

Results. After the first year of the field experiment, there was a significant difference ($p < 0.05$) in the DOC concentration among the different grassland communities but no effect on the soil microbial composition. Moreover, we found that DOC was positively related to total microbial biomass as well as the bacterial biomass ($p < 0.05$) but not significantly related to the fungal biomass.

Conclusions. Multispecies communities with different levels of species richness have differential effect on DOC concentration and there is evidence of significant relationship between DOC and certain soil microbial groups. However, the direct effect of these multispecies grasslands on the soil microbial communities was not evident after the first year of this study.

Oral Presentation

Coenosystematic analysis of sandy grassland in the centre of Carpathian Basin

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Introduction. We examined the sandy grasslands in steppe-forest-steppe vegetation along the Danube in the central part of the Carpathian Basin.

Aims. We studied the grasslands in terms of coenology, focusing on the dominant *Festuca* taxa.

Methods. The survey was conducted on 4 different locations in the Carpathian Basin. Cover of dominant grass (*Festuca*) species was used as an indicator value. Pedological background was also examined.

Results. Coenosystematic analysis has shown *Festuca pseudovaginata* mainly in forest-shrub areas, and the samples also contained elements of *Quercetea pubescentis-petraeae* and steppe taxa. In *Festuca wagneri* grasslands, proportion of taxa of *Festucetalia valesiaca* and *Festuco-Brometea* was higher. In addition, all three vegetation types were less diverse at their northern and southern edges, and contained also forest, steppe and closed grassland species at greater proportion. The *Festuca pseudovaginata* has evolved on forest soils. The soil profile showed 1,5 m deep forest soil, and the amount of organic matter was higher.

Conclusions. The dominant *Festuca* taxa of these vegetation types are good indicators of the changes in the vegetation and their ecological background. The central sandy grassland, forest-steppe areas of the Carpathian Basin have become mosaic-like, but the present survey affirmed that several patches of the original vegetation have remained.

Acknowledgement. The survey was supported by OTKA K-125423.

Poster Presentation

Vegetation succession of abandoned cropland in semiarid environments at Bardenas Reales Biosphere Reserve (Navarre, NE Spain)**Javier Peralta¹, Leticia San Emeterio², J. Bosco Imbert^{1,3}, Alejandro Urmeneta⁴, Federico J. Castillo^{1,3}**¹ Sciences Department, Public University of Navarre, Pamplona, Navarre, Spain² IS-Food, Public University of Navarre, Pamplona, Navarre, Spain³ IMAB, Public University of Navarre, Pamplona, Navarre, Spain⁴ Comunidad de Bardenas Reales, Tudela, Navarre, Spain

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Question. Bardenas Reales is an area of commons with open habitats under Mediterranean semiarid climate; the two main land uses are sheep grazing and extensive dryland farming. This work studies the process of plant succession in abandoned crops, to assess the time required to evolve towards the nearby seminatural vegetation and the influence of livestock grazing.

Methods. Four experimental contiguous plots were set on slopes at each of two sites: two plots with shrubland in their upper part and another two with crops ceasing cultivation in the lower; one plot of each vegetation type was fenced to exclude livestock. Vegetation cover (spring and autumn) and floristic composition (spring) were measured for ten years in 36 quadrats of 0,1 m² per plot. Changes in vegetation cover, species richness and diversity were analyzed using generalized least squares and floristic turnover by multivariate analysis.

Results. Vegetation cover had a steep increase during the first 2-4 years in former crop plots; afterwards vegetation cover dynamics followed interannual climate shifts and it reached that of shrubland open plots 2 to 8 years after cultivation cessation. Perennial species cover increased since 4-5th year. Species richness and diversity values, higher in years with favourable climate, attained those of the shrubland plots 2 to 6 years after abandonment; the number of species was generally higher in open plots. Floristic composition of former crop plots has not reached still that of nearby shrublands.

Conclusions. The observed changes seem to be conditioned by climate, soil, livestock grazing and adjacent vegetation type. The time to reach the vegetation cover of shrubland plots was longer when grazing was higher. The increase in perennial species cover could be an indicator of a shrub encroachment process, possibly related to changes in livestock management. The presence of livestock seems to have a positive effect on species richness and diversity, at least when the load is moderate. Floristic turnover in crop plots towards shrubland vegetation is a slow process, longer than 10 years' time, facilitated by livestock presence. Floristic convergence depends also on the nearby plant communities' structure, being slower when this structure is more developed.

Oral Presentation

Is it possible to make a floristic discovery within European grasslands?**Mykyta Peregrym^{1,2}, Svitlana Zhygalova³ & Igor Olshanskyi³**¹ Luhansk Taras Shevchenko National University, Poltava, Ukraine² Matej Bel University, Banska Bystrica, Slovakia³ M.G. Kholodny Institute of Botany, NAS of Ukraine, Kyiv, Ukraine

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Ukraine is the largest European country the whole territory of which is located within the continent. Its diversity of vascular plants has been researched greatly (Flora URSS, Vol. I-XII (1936-1965)). And the last nomenclature summary is the checklist (Mosyakin & Fedoronchuk, 1999). But data about new species and hybrids for Ukraine appears periodically since that time.

Aim is to estimate how many species of vascular plants have been reported for the first time in Ukraine during the last 25 years focusing on their taxonomy, origin, locations, habitats etc. Separately, we tried to understand how many new species can be found in European grasslands and what should be done to discover them on the example of the Ukrainian flora.

Methods. We prepared a literature review using Scopus, Web of Science and PubMed databases as well as not indexing periodical editions and monographs published in Ukraine and Russia mostly in Slavic languages.

Results. Patterns in the discovery of new species of vascular plants within the Ukraine during the last 25 years have been established. Their total number is in-stated. Also, it has been possible to divide these findings into several groups: new species for science described from territory of the country; alien species, which have recently appeared in the country; native ones, but previously undetected or overlooked; and others. Moreover, administrative and natural regions as well as habitats where the biggest number of new species for the flora of the country was reported are allocated.

Conclusions. Several tips have been developed for better inventory of the flora of Ukraine on the basis of the obtained data. Namely, we paid attention to the most prospective regions and habitats where new species of vascular plants may be found. Also, with reference to the most complicated taxonomic groups, in which relevant revisions for the Ukrainian flora have not been carried out yet. Additionally, we offer botanists to be more involved in Citizen Science that allow making floristic discoveries too. Everything mentioned above and some other nuances will be shown and discussed during our oral presentation.

Oral Presentation

Changes in livestock management and evolution of montane grazing habitats in 15 Protected Areas of the Basque Country**Francisco-Javier Pérez**

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Objectives. According to the European Commission's State of Nature report (2013-2018), the conservation status (CS) of the pastures is BAD and it is also getting worse. The cause is the change in extensive agricultural practices (intensification or abandonment). Based on this, LIFE OREKA MENDIAN aims to assess the EC of mountain grazing habitats in the Basque Country, its temporal evolution and associate it with changes in livestock use.

Scope: 15 Special Areas of Conservation (SAC). Top 5 Target Habitats (HCI): 6230*, 6210, 6170, 4030, 4090.

Methods. Assessment of trends in vegetation. Review of vegetation/habitats (year 2017): 1:5,000 scale mapping update. Comparison with the pre-existing cartography (2009). The changes are adjusted based on lithology and Vegetation Series, in order to assimilate changes and natural succession. Assessment of trends in livestock farming. Livestock authorized in Public Mountains (annual number of heads of sheep, horses, cattle and goats), number of farms. Comparison of the years 2006 and 2016, using AU (Animal Units). Surveys of farmers.

Results. General trends. Loss of surface in herbaceous HCI: 6.2%, mainly due to colonization of ferns. Disappearance of 9% of the habitat surface 6230*, slight increase of 6210(*). Changes in the surface of HCI scrub: 8% decrease in 4030 and 2% increase in 4090. Increase in the surface covered by *Ulex* sp. Damping of heaths with *Ulex* and increase in thorns (preforest). Livestock increase. Change of species: decrease in small livestock (sheep-10% / goat-18%) and increase in large livestock (horse +31% / cattle +15%). Total Charge AU increases 9% AU. At SAC level. Some are getting more bushes rapidly and to a great extent >10% (Ordunte, Gorbeia, Jaizkibel, Urkiola), others in equilibrium (Aralar, Aizkorri-Aratz...) and in others the process is reversed (Aiako Harria, Entzia and Pagoeta). Livestock: Increased livestock load in some (Arkamo, Aizkorri, Ordunte...>20%) and decrease in others (Jaizkibel, Urkiola, Izki, <-30%). Direct correlation between thickets and the decrease in livestock density in Jaizkibel and Urkiola, but not in other SAC. Causes: distortion of livestock data authorized by CAP aid, large clearings, animal preferences, etc.

Conclusions. Confirmed the deterioration of the EC of Basque grazing HCI: loss of herbaceous surface and heathland depletion. Total livestock load increase. Change of species of small to large livestock, which affects the EC, as well as lack of directed grazing. Differences between SAC. Livestock data conditioned by CAP, surveys of real use are necessary. Areas with insufficient livestock use imply very rapid deterioration of HCI. A minimum livestock load is essential. The maintenance of sheep grazing is related to good EC. Adjustment of livestock density is insufficient to restore HCI, additional clearing is also necessary.

Poster Presentation

A preliminary review on the gypseous vegetation of Central-Eastern Europe

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Question (Aims). Outcrops of gypsum materials, although more abundant in dry and arid areas, are a global phenomenon. This fact is called “edaphism” and consists in the set of geobotanical phenomena dependent on the gypsic nature of the substrate and, is called “gypsophily”. The gypsum, due to the restrictions they impose on plant development, are known to be home to a peculiar flora, often with endemic or stenochorous taxa. However, it would be a mistake to focus on the gypsophila only as a “generator” of endemic taxa. The set of geobotanical phenomena include changes in flora and vegetation, although they do not entail absolute restrictions on the gypsum substrate. This is fully consistent with the very scarce, sparse, and desolately dry appearance of the gypsum areas vegetation. The gypsiculous vegetation of the Mediterranean area has drawn the attention of botanists. But the outcrops of Central and Eastern Europe have been less studied (perhaps because of their poverty in exclusive species). The aims are to carry out a preliminary study of the gypsum vegetation of central-eastern Europe and its comparison with surrounding vegetation.

Methods. Phytosociological relevés were collected from various bibliographic sources covering Switzerland, Germany (both northern —Thuringia— and southern —Bavaria—), Italy (area bordering Austria), Austria, Poland, Romania and Ukraine. All the relevés had to indicate explicitly that they were recorded on a gypsum substrate. After compilation, they were statistically treated with usual techniques in multivariate analysis (Cluster analysis, Principal Component Analysis, etc.).

Results. Preliminary results point out the floristic singularity of the Swiss gypsum vegetation (perhaps due to the height factor) and Romanian. It emphasizes the, already mentioned, presence of more xerophilic elements than the surrounding flora.

Conclusions. In addition, they emphasize the presence of more xerophilic elements than the surrounding flora. It is not for nothing that gypsum outcrops have been considered “dry-islands”. This fact is important from the Conservation Biology point of view.

Poster Presentation

Adaptation to contrasting soil conditions has led to the evolution of ecotypes in *Santolina semidentata* Hoffmanns. & Link

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Question (Aims). Plants can cope with environmental variation either by phenotypic plasticity or by genotypic changes that lead to the formation of local ecotypes. *Santolina semidentata* is a subshrub endemic to open areas in the NW of the Iberian Peninsula, where it behaves as a primary coloniser in soils with contrasting conditions. We ask whether the colonisation of different soil types by *S. semidentata* has led to the appearance of edaphic ecotypes or only to a wide phenotypic plasticity?

Methods. Three populations of *S. semidentata* (AC, RL and SA, growing on soils derived from limestone, granodiorite and serpentinite, respectively), one population of *S. rosmarinifolia* (PR) and one population of the serpentinite-endemic *S. melidensis* (RS) were cultivated in the soils from the sites where *S. semidentata* samples were collected, in a reciprocal transplant experiment in a greenhouse. The plants were harvested after 18 weeks, and the shoot and root biomass were measured. The effects of factors soil, population and the soil * population interaction were assessed with a split-plot design, and the data were fitted using a mixed linear model.

Results. Only the SA and RS populations (originated from serpentinite soil) and a couple of plants from populations AC and RL survived when cultivated in serpentinite soil. By contrast, no differences in plant growth were observed between limestone and granodiorite-derived soils, in which plant survival was almost 100%. Plant biomass differed significantly between populations, with the serpentinite-endemic *S. melidensis* having the lowest biomass.

Conclusions. Colonisation of ultramafic soils has led to the evolution of an adapted ecotype in *S. semidentata*. In other soils, where conditions are less extreme, phenotypic plasticity is the main mechanism of adaptation. The presence of some serpentinite-tolerant individuals in non-serpentinite populations of *S. semidentata* indicates the presence of pre-adaptive mechanisms that have enabled the spread of this species in such a stressful environment.

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Oral Presentation

Past and present impact of land-use change on plant-pollinator interactions in East European grasslands**Demetra Rakosy^{1,2}, Ana-Maria Neacă³, Julia Meis¹, Thomas Hornick^{1,2} & Susanne Dunker^{1,2}**

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Aims. Eastern Europe harbors some of the world's most diverse semi-natural grasslands. These grasslands are under strong anthropogenic pressure, particularly due to land-use change. Land-use change is however not a new threat, as during the last four decades many Eastern European countries have gone through periods of significant land-use change. It has become urgent to understand the degree of plant and insect declines following changes in land-use and the consequences for the structure and function of plant-pollinator interactions. However, long-term changes in these interactions are largely unknown, mainly due to the deficit of long-term data. The present contribution aims to contribute in closing this knowledge gap by assessing historical changes in plant-pollinator interaction structure and function by analyzing pollen carried by specimens in museum collections.

Methods. We used the pollen stored on insect bodies to reveal temporal changes in plant-pollinator interaction patterns. Similarly, we used pollen on the stigma of plants in herbaria to assess changes in pollination efficiency. We thereby focused on Bombyliidae and flowering plants collected from the “Fănațele Clujului” protected area near Cluj-Napoca, Romania around 1960 (before the onset of land-use intensification) and again in 2021 (following two periods of land-use intensification). We complement this dataset by a present day comparison of full plant-pollinator interaction networks in grassland areas continuously managed as extensive hay meadows and former hay meadow areas which are presently intensively grazed.

Results and Conclusions. Our results indicate how the composition of the pollen carried by Bombyliidae and the amount and type of heterospecific pollen deposited on plant stigmas has changed through time, and discuss the possible influence of land-use change on these patterns. In addition we highlight differences between hay meadows and intensive pastures in terms of plant and pollinator diversity, as well as plant-pollinator network structure. Changes in the last 40 years could have shifted the plants Bombyliidae preferentially visited, while also leading to shifts in pollen deposition on plant stigmas. Land-use change is thereby likely to have altered the diversity and composition of both plant and pollinator communities as evidenced from the present day differences between hay meadow and pasture sites.

Poster Presentation

Management of Japanese Rose *Rosa rugosa* Thunb. in open coastal dune habitats in Latvia**Solvita Reine, Ieva Rove**

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Testing of new approaches/methods for management of invasive alien species. The aim of the action is to test invasive alien species (IAS) eradication methods which are novel or little approved in Latvia, and which later could be applied in other IAS invaded territories both in Latvia and abroad. The action aims to develop applicable, cost-effective methods with high replication potential, suitable for the Latvian conditions.

Rosa rugosa: locally, it is possible to eliminate this species locally, on a basis of its distribution vectors. *Rosa rugosa* is distributed in certain habitats, and it is possible that, using the experience gained from the project, we will be able to destroy at least the most of its colonies in the long term. Selection of pilot areas and methods for forest habitat management and eradication of invasive alien species, preparation of documents necessary for the implementation of management and restoration actions in forest habitats and eradication measures in selected pilot sites. For testing the IAS eradication methods, five target species/genus are selected (the most aggressive species that lack knowledge on cost-effective eradication methods – *Rosa rugosa*, *Impatiens glandulifera*, *Solidago* spp. (*Solidago canadensis*, *Solidago gigantea*), *Acer negundo* and *Amelanchier spicata*). The choice of these species is determined by several factors. *Rosa rugosa* was selected as one of the target species by taking into account the species traits and vectors. It is highly probable that locally complete elimination of this species is possible (assumed on basis of previous evidence). *Rosa rugosa* invades specific habitats, mostly open coastal dunes which are geographically limited, rarely occurring elsewhere inland. It is credible that, using the experience gained during the Project, it will be possible to completely eradicate at least the most of its colonies in natural habitats: foredune and grey dune habitat restoration – removal of invasive species *Rosa rugosa*; works area 10 ha × 1 time. Vegetation floristic composition and spatial structure of open dune habitats in Latvia is not homogenous. It varies from extremely dry and sparse close to the Baltic Sea and more densely vegetation covered towards inland, without ecologically necessary disturbances develops in process of secondary succession towards: shrubland or forest with some stages of grasslands. Within activities of Integrated LIFE project LIFE IP LatViaNature management of Japanese Rose in open coastal dune habitats takes place since January of 2021: optimisation of light conditions maintaining partly opened and sunlit structures, thinning out and mowing rose shrubs, removing expansive leaf trees and shrubs; Implemented activities will support development of natural open coastal dune habitats and favourable conservation status of target habitat which is object of regular surveillance. Cumulative there is positive impact on Sea-holly *Eryngium maritimum* coverage and vitality in foredunes.

Poster Presentation

Can carbon amendments mitigate negative drought effects in Swedish grasslands?

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Question (Aims). Grasslands play a vital role for many ecosystem services such as fodder production, biodiversity and carbon storage. With climate change, droughts are becoming more frequent and severe in many parts of the world and they can affect grasslands' productivity and diversity. One possible solution to mitigate negative drought effects could be the application of carbon amendments. Such amendments offer moreover a high potential for carbon sequestration. We investigate how droughts and carbon amendments are affecting both above- and belowground processes. In this study, we focus on the effects on aboveground plant biomass, plant diversity and floral resources for pollinating insects.

Methods. Our study area is located in southern Sweden and consists of four semi-natural grassland sites with twelve plots in each site (plot size 2x2 m). In July 2019, we installed rainout-shelters that reduce precipitation by 58 % during the growing season (April-October) with the same setup as the Drought-Net Research Coordination Network. For the carbon treatment, we applied 11 kg wet compost per m² made of maize (*Zea mays*) in February 2020. We have replicated our four treatments (i.e. drought, drought & compost, compost, control) three times in each site.

Results. Although the experiment is still ongoing, our measurements so far indicate that soil moisture is decreasing down to 40 cm soil depth under the drought treatment, and that carbon amendments are not buffering this decrease. However, the carbon amendments seem to mitigate negative drought effects on aboveground plant biomass. Our preliminary results indicate that the biomass of both graminoids and non-leguminous forbs increases with carbon amendments, but not that of legumes. Regarding floral resources, the carbon amendments tend to stabilize nectar provision over time (driven by only a few species) and enhance the total number of floral units.

Conclusions. In conclusion, carbon amendments could be an effective approach to mitigate negative drought effects on plant productivity in Swedish grasslands. However, their effects on plant diversity and floral resources are more complex and dependent on the plant community in question.

Oral Presentation

***Aizjoms* – ancient extensive agriculture land “behind beach”
in old fishermen villages along SW coast in Latvia****Ieva Rove**

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Coastal sand dune habitats are represented by 8 (eight) European Union importance habitats in Latvia. These habitats cover significant terrestrial area in Coastal Lowland of Latvia. Nevertheless, not all significant and valuable coastal plant communities and habitats are noticed and valued.

We have analysed vegetation descriptions representing ***aizjoms*** dominated by herbaceous plants previously not described. The aim is to clarify subtypes and successional pathways of older successional stage vegetation of ***aizjoms*** in the SW of the country – the main distribution area of the core subject.

Aizjoms is a flat, man made shaped area in the Coastal Lowland, behind fore-dune towards inland, surrounded by man made and shaped sand ridge, literary – an area behind beach, “beach” according to ancient local fisherman term – stretch of beach where boats and fishery equipment are stored where not going in the Sea. ***Aizjoms*** is a flat area with sharp edges close to the sea level in coastal dune systems, which lies among ridges of coastal dune systems. It occurs within primary, secondary and relative stable dunes on post Baltic Ice Lake transition area in Latvia, including post Littorina Sea impact area in Coastal Lowland. These systems were made to get more fertile and moist area for extensive agriculture, feed by pink algae *Furcellaria lumbri-caulis* etc. layers.

The compositional patterns of ***aizjoms*** in fishermen village ***Jūrmalciems*** are varied and have complex relationships. The set of species selected by indicator species analyses at a given order of site group combinations reflects the ecological drivers that filter different species traits at that scale of analysis. Second main driver is former management, indicating cultural value of these systems.

Vegetation floristic composition and spatial structure of ***aizjoms*** in Latvia is not homogenous. It varies from extremely dry close to foredunes to dry or wet towards inland, as well as, composition of vegetation varies. ***Aizjoms*** without traditional management develops in process of secondary succession towards: shrubland, wetland or forest with some stages of grasslands.

Poster Presentation

Effects of woody plant encroachment on diversity in mesoxerophyllous grasslands**Sara Sánchez-Carmona, Juan Antonio Campos & Itziar García-Mijangos**Department of Plant Biology and Ecology,
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Question (Aims). Mesoxeric grasslands have traditionally been used by humans as areas for livestock grazing. Due to socio-economic changes since the mid-20th century, these pastures have been increasingly abandoned, which has allowed the advance of secondary succession towards woody communities through the process of woody plant encroachment (WPE). This herbaceous habitat forms an ecosystem of high ecological value and great biodiversity, which is being reduced due to the invasion of shrub communities. In the present study, the changes that occur in the different components of biodiversity in sub-mediterranean grasslands of the center-north of the Iberian Peninsula will be analyzed. Moreover, state and transition models (STM) will be built and evaluated to understand the patterns and processes that structure the grassland communities in the process of WPE. The study will be carried out at different levels of organization (alpha and beta diversity, as well as concerning taxonomic, functional and phylogenetic diversity) and at different spatial scales, in a scenario land-use change. Likewise, by using the STM models, scientific bases will be established to carry out adequate management that will help to preserve or increase their levels of natural biodiversity.

Methods. The study area lies in submediterranean areas of Burgos and Álava provinces (Spain). The sampling is made in semi-natural grasslands of habitat type 6210 (*important orchid sites) in Habitat Directive (92/43/CEE) included in the *Festuco-Brometea* class. The encroaching shrubs belong to habitat type 4090, mainly included in *Festuco-Ononidetea* class. Biodiversity nested-plots series are sampled across the WPE gradient, establishing at least three levels of shrub encroachment. The plots cover six spatial scales, from 1 cm² to 10m², and two 1m² plots are sampled in two opposite corners of the 10m² plot. In each of the plots, the shoot presence of all species of vascular plants is recorded, and the cover of each plant is estimated in 10 m² plots. For this plot size, the detailed environmental data are obtained. Data on topography and soil are also taken.

Results. We will present the partial results from the first sampling this year.

Oral Presentation

Plant diversity patterns in restored estuarine habitats of the Cantabrian coast**Sara Sánchez-Carmona, Juan Antonio Campos & Idoia Biurrun**Department of Plant Biology and Ecology,
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Aims. Salt marshes are coastal areas of great ecological value that have traditionally suffered strong anthropogenic transformations. In the salt marsh of the Barbadún river (Bizkaia, Spain) there were some hydrocarbon storage facilities for decades, which were shut down, and the restoration actions were finished in 2012. Our main objective was to analyze the evolution of the restored zone between 2016 and 2020.

Methods. 47 biodiversity nested plots series were sampled in both natural and restored zones in 2016 and 2020. The plots cover six or seven spatial scales, from 1 cm² to 10 m² or 100 m². In each of the plots, the shoot presence of all species of vascular plants was recorded, and the cover of each species was estimated in 10 m² and 100 m² plots. Data on vegetation structure and abiotic characteristics were recorded and mixed soil samples were collected in 10 m² plots. Alpha diversity was calculated both as species richness and Shannon-Wiener index at plot level, and z values were calculated in each nested series as a measure of fine-grain beta diversity. Phylogenetic diversity was measured by means of the average taxonomic distinctness (Δ^+).

Results. The difference between natural and restored zones was significant for both years. In the restored zone, the taxonomic diversity values were always higher at alpha and beta levels and the phylogenetic diversity significantly lower than in the natural zone. In the year 2020 five vegetation types could be distinguished and the factors that most explained the variation between them were soil salinity and flood level.

Conclusions. In general, it is possible to perceive a tendency of the restored area to reach the natural state of the ecosystem. Taxonomic alpha and beta diversity shows higher values in the communities of the restored zone, which could be related to the intermediate disturbance hypothesis. On the other hand, these same communities show phylogenetic clustering, which could be due to the important influence of the abiotic environment on the early successional stages.

Oral Presentation

LIFE Nardus & Limosa: grassland restoration for meadow birds, on fertilized fields

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Aims. Land-use intensification has caused the loss of many *Nardus* grasslands in Western Europe. Bioavailable soil phosphorus concentrations are now generally higher than the threshold above which typical *Nardus* grassland species get outcompeted by fast-growing plant species. Abiotic restoration typically involves removing phosphorus with biomass harvests, by mowing or the more intensive phosphorus mining, or topsoil removal. In areas with small remnant populations of meadow birds such as black-tailed godwit (*Limosa limosa*) and Eurasian curlew (*Numenius arquata*), these abiotic restoration techniques may negatively affect the local meadow bird populations as mowing and phosphorus mining can destroy nests and topsoil removal takes away the earthworm population, the main food source for nesting birds. With LIFE Nardus & Limosa, we aim at combining the abiotic restoration of *Nardus* grasslands with maintaining meadow bird populations.

Methods. In 4 study areas in Belgium and the Netherlands, we performed a large abiotic screening to map the soil phosphorus concentrations of 700 sampling points and identify their restoration potential by assessing the distance to the soil phosphorus threshold for *Nardus* grasslands. For sampling points above the abiotic threshold, we modelled the time to remove phosphorus with 3 abiotic restoration techniques: mowing management adapted for meadow birds, phosphorus mining adapted for meadow birds and intensive phosphorus mining.

In June 2021, we set up a field experiment to locally monitor phosphorus removal with the 3 abiotic restoration techniques and validate our model assumptions.

Results. In dialogue with the field practitioners, we combined the map of grassland restoration potential with the preferred nesting sites of the meadow birds and other local constraints. We will also present the first results from the field experiment.

Conclusions. Phosphorus-poor soils were rare in the study areas and should be prioritized for conservation and biotic restoration. For fields with an estimated abiotic restoration time longer than 30 years (i.e. the 2050 EU target), we proposed topsoil removal or pursuing another, less phosphorus-critical grassland type.

Oral Presentation

Dry grasslands of Southern Buh River valley in the steppe zone of Ukraine

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Question (Aims). The Southern Buh River is one of the biggest Ukrainian rivers with diverse landscapes and flora, especially its down reaches located in the steppe zone. However, phytosociological data on the grassland vegetation of this region is poorly represented in literature and phytosociological databases. Our study aims to survey grasslands in the Southern Buh River valley in the steppe zone, investigate the main environmental factors determining their differentiation and explore biodiversity patterns (species-area relationships).

Methods. In 2018-2020, we sampled vegetation relevés using EDGG methodology (47 biodiversity plots and 310 normal plots) for all dry grassland types represented within the study area. We used JUICE 7.1, R4.1 and QGIS3.16 for data analysis and visualisations.

Results. The diversity of dry grasslands is represented by classes *Festuco-Brometea*, *Koelerio-Corynephoretea*, and *Sedo-Scleranthatea*. Main vegetation types include true forb-bunchgrass steppes (*Stipo lessingiana-Salvion nutantis*), meso-xeric meadow steppes (*Cirsio-Brachypodium pinnati*), narrow-leaved fescue steppes (*Festucion valesiaca*). Extrazonal communities are distributed on specific substrates, such as petrophytic steppe communities on siliceous (*Poo bulbosae-Stipion graniticolae*) and limestone (*Potentillo arenariae-Linion czernjajevii*) outcrops, Pontic sandy grasslands on alluvial sands (*Festucion beckeri*). Syntaxonomical assignments of transitional vegetation types (e.g. hemipsamphytic grasslands), southern semi-desert communities and sparse *Sedo-Scleranthetalia* vegetation are preliminary and need further clarification. Also, we investigated the influence of bioclimatic variables, substrate type, soil properties, microrelief and land use on the differentiation of studied grasslands. The biodiversity patterns are varying among the vegetation types, and correspond to climatic variables for the zonal vegetation.

Conclusions. The presented study provides the first comprehensive overview of vegetation-diversity patterns of dry grasslands in the Southern Buh River valley in the steppe zone. We believe that our findings will shed light on the complicated syntaxonomy of the dry grasslands of Eastern Europe and bring further clarification to the vegetation and biodiversity knowledge on both national and European levels.

Poster Presentation

Wild plant species introduction in urban lawns: can engagement of urban residents increase biodiversity**Rūta Sniedze-Kretalova², Liene Brizga-Kalniņa^{1,2} & S. Rūsiņa¹**¹ University of Latvia² Latvian Fund for Nature

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Question (Aims). Lawns are increasingly used to enhance ordinary biodiversity in urban environments. Previous research has mostly focused on public urban areas in Central and Western Europe but Eastern European and private lawn perspective has been scarcely studied. Our study focused on private lawns in Latvian towns. We aimed to evaluate the interest and engagement of urban residents to increase biodiversity on their private land and to assess the success of wild plant species addition in their lawns as well as the impact of the species introduction process on attitudes of the residents.

Methods. In September 2020 Latvian residents were invited to express their interest in sowing one square meter of grassland flowers in their lawn. The campaign “Saw your own square meter” was announced and managed by Latvian Fund for Nature (LFN). LFN received 1864 applications, 700 packages containing ca. 3 g seeds of 20 out of 33 wild plant species were sent. 238 applicants agreed to participate in the research. From those, 68 randomly chosen sites were sampled in summer, 2021. In each site, seeded 1m² plot and typical lawn vegetation was sampled in 1m² and 25m² plots. In summer 2022 the participants of the research participated in a survey about their experience, attitudes to wild plant species and biodiversity.

Results. Cluster Analysis resulted in four plant communities corresponding to EUNIS habitats V35 Trampled mesophilous grassland, V31 Agriculturally-improved grassland, including sports fields and grass lawns, Mesic (V39) and dry (V38) perennial anthropogenic herbaceous vegetation. Sown plots contained significantly more species (19 versus 12) than existing lawns due to higher number of weeds. 4.3 ± 1.6 out of 20 sown species were counted on average, while 18 out of 33 sown species occurred also naturally in sampled lawns. 7 species (Galium verum, Trifolium montanum, Lychnis flos-cuculi etc.) did not germinate while the most successful were Leucanthemum vulgare, Prunella vulgaris, Galium album, Agrimonia eupatoria, Anthyllis vulneraria. Participant survey is carried out in summer 2022 and at the time of submission of this abstract are not available yet.

Oral Presentation

**Land use change and vegetation succession
in marginal protected areas of Central Apennines****Giulio Tesei, Lorena Baglioni, Luca Bassetti, Paride D'Ottavio,
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Aims. Seminal calcareous grasslands are among the most species-rich ecosystems globally. The under-use and abandonment of the traditional management practices, especially in mountain marginal areas, have triggered natural dynamic processes with the advancement of new forests and consequent drastic reduction of biodiversity. This study reports the land use changes recorded in a protected area of central Apennine over a period of 60 years and the analysis of the space-time succession of underused grasslands [(habitat code *6210, *priority habitat)] towards the beech forest.

Methods. In the Regional Nature Reserve of Monte San Vicino and Monte Canfai, a diachronic analysis by photo-interpretation of the 1952, 1978, and 2012 orthophotos was carried out to identify and analyze the variation over time of the following categories: forests, shrublands, grasslands, and arablelands. To identify the plant communities involved in the vegetational dynamics and the floristic turnover, floristic-vegetational surveys were carried out according to the phytosociological method, starting from the beech forest that was already present in 1952, to the grassland.

Results. At the landscape scale, a total variation of 39.5% in land use was recorded between 1952 and 2012. In particular, the forests increased by 19.3% in the period 1952-1978 and by 11.3% between 1978 and 2012. On the other hand, the grasslands decreased between 1952 and 1978 by 22.6% and by 9.1% in the period 1978-2012. At the community level, the vegetation and structural analysis of the different plant communities present along the succession trajectory, from beech forest to grassland, has allowed the identification of floristic and ecological bioindicators of the different stages and the species turnover.

Conclusions. The significant increase of forests and the drastic reduction of grasslands highlighted by the diachronic analysis are in agreement with what has already been observed in general for the entire Apennine chain. The floristic and the ecological bioindicators of the different stages of the succession, and in particular those of the earliest stages of the dynamic processes, were crucial in determining the floristic turnover that occurs in the grasslands already immediately after its abandonment or under underuse condition.

Oral Presentation

**Invasion of the North American sand dropseed (*Sporobolus cryptandrus*)
in sand grasslands of Hungary**

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Questions. For the control of an invasive species availability of information related to its ecology, establishment and persistence in the subjected communities is decisive. We aimed to study the current distribution and characteristics of *Sporobolus cryptandrus* (sand dropseed), an invasive C4 grass species of North American origin recently discovered in sandy areas of Hungary. We aimed to study (i) its current distribution paying special attention to its invasion in Eurasia; (ii) the characteristics of the invaded habitats in Central Europe; (iii) seed bank formation and germination characteristics, crucial factors in early establishment; and (iv) the effects of its increasing cover on vegetation composition.

Methods. Distribution of the species were mapped and vegetation composition (cover of species) and seed banks (seedling emergence method) of invaded sites were analyzed in 2020-2021.

Results. Field surveys uncovered large stands of the species in Central and Eastern Hungary with most of the locations in the former, especially in the Kiskunság region. Increasing cover of *Sporobolus cryptandrus* was associated with a decline in richness and abundance of subordinate species both in

Oral Presentation

the vegetation and seed banks. Viable seeds of *Sporobolus* were detected from all soil layers (2.5 cm layers measured from the surface to 10 cm in depth), which indicates that the species is able to form a persistent seed bank (1,114 to 3,077 seeds/m² with increasing scores towards higher abundance of the species in vegetation). Germination of *Sporobolus cryptandrus* was negatively affected by both litter cover and 1 cm deep soil burial. To sum up, *Sporobolus cryptandrus* can be considered as a transformer invasive species, whose spread forms a high risk for dry sand and steppe grasslands in Eurasia.

Conclusions. We can conclude that for the effective suppression of the species it is necessary to clarify the origin of the detected populations; to assess its competitive ability including its potential allelopathic effects; to assess its seed bank formation potential in habitats with different abiotic conditions; and to assess the possibility of its suppression by natural enemies and management techniques such as mowing or livestock grazing.

Oral Presentation

The forecast of anthropogenic transformations of the Azov sea spits and their vegetation**Oksana Tyshchenko**

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Question (Aims). Estimation of the degree and dynamics of transformation of unique Azov-type spits (north coast of the Azov Sea, Ukraine) and their vegetation, revision of the forecast from 2001 due to the increased levels of anthropogenic impact.

Methods. More than 900 grassland relevés, a set of vegetation maps covering ~90-year period, Ukrainian public cadastral map orthophoto plans (<https://map.land.gov.ua>), retrospective Google Earth images (<https://earth.google.com/earth/>).

Results. A general trend of transformation of Azov-type spits and their vegetation caused by inundation was documented more than 20 years ago. Today this process continues, especially due to sea-level rise as a major effect of global warming. Infrastructural facilities on the spits have to remove excess water several times a year by pumping it out. The narrowest parts of the spits are periodically destroyed by storms and will likely become isolated islets with possible changes in their outlines in the future. The spits littoral (*Ammophiletea*, *Crypsitea aculeatae*), psammophytic-steppe (*Festucetea vaginatae*), and halophytic (*Salicornietea fruticosae*, *Thero-Salicornietea strictae*) plant communities continue to be replaced by halophytic-meadow (*Asteretea tripolium*, *Juncetea maritimi*), marsh and aquatic (*Phragmiti-Magnocaricetea*, *Bolboschoenetea maritimi*, *Potametea* and *Zosteretea*) communities. This transformation will continue in the future. Zonal steppes (*Festuco-Brometea*) on adjacent to the spits' continental slopes and on the Stepok loess island (Fedotova Spit) are significantly affected, so cannot return to the state of primary zonal typical steppes in the near future. The increase of anthropogenically transformed areas and reduction areas of natural vegetation were recorded. Spits could lose their recreational potential soon due to the changes in the ecosystem of the Azov Sea: abnormal high salinity and temperature, nutrient pollution and critical outbreaks of invasive species, especially *Rhizostoma* and *Aurelia*. It is caused by unbalanced water consumption from the Kuban and Don river basins, continental water pollution, plowing, industry development, Crimean Bridge construction, etc. The Russian Federation's aggressive military invasion is the most catastrophic current anthropogenic activity in Northern Pryazovia.

Conclusions. The current anthropogenic transformation of the Azov-type spits and their vegetation continues. This confirms our 20-years ago forecast and is expected to be intensified in the future.

Oral Presentation

Conservation of pastureland habitats and control of scrub-spreading in Gorbeia ZEC: clearing vs. livestock-grazing**Ainhoa Urkijo¹, Ibone Ametzaga², Javier Sesma³, Txomin Díaz⁴ & Isabel Albizu¹**

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Question (Aims). This study was designed in the LIFE Oreka Mendian (LIFE15 NAT/ES/000805) project – “Conservation and management of Basque mountain grasslands” and its aim was to define actions for pastureland conservation based on livestock-grazing in Gorbeia ZEC (Special Conservation Zone). Livestock behavior was analyzed to observe their movements within scrub zones and cleared pasture zones at different slope-ranges.

Methods. Livestock-grazing was monitored in Gorbeia ZEC by placing GPS on the herd's leader animal in 2018, 2019 and 2020. Location registers were analyzed based on the selection that livestock had towards different slope-ranges (<30%, 30-50% and >50%) and pasture-categories (forest, unproductive, scrub and pasture), together with scrub cleared zones between 2017-2020. This selection was measured by the Jacobs index. Similarly, the time that livestock spent grazing on each zone was estimated by the percentage of location-registers that the GPS made each time.

Results. In general, livestock was observed to have a significant higher preference for <30% slopes, being this preference higher for equine and beef livestock than for sheep. At the same time, livestock showed a preference for pastures all year round, even if in Autumn they showed a preference for scrubs (compared to other seasons). When comparing livestock behavior between cleared zones and scrubs within the same slope-ranges, no preference was observed. However, at <30% slope-ranges livestock spent more time on cleared zones than on scrubs, not showing differences in the other two slope-ranges.

Conclusions. In summary, clearing actions should be prioritized at <30% slope-ranges because of the livestock's positive selection towards them and greater time spent at them. At the same time, Autumn would be the season when livestock could better control scrub-spreading in a more natural way rather than clearing.

Poster Presentation

Livestock behavior analysis in threatened flora zones in Aldamin-La Cruz pastureland (Special Conservation Zone of Gorbeia)**Ainhoa Urkijo¹, Ibone Ametzaga², Amador Prieto³ & Isabel Albizu¹**¹ Department of Conservation of Natural Resources,
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Question (Aims). This survey was designed in the LIFE Oreka Mendian (LIFE15 NAT/ES/000805) project – “Conservation and management of Basque mountain grasslandsand”. Its aim was to assess the impact of livestock-grazing on threatened flora distribution through Aldamin-La Cruz pastureland in Gorbeia ZEC, contributing to the optimization of the actions to be planned.

Methods. A spatial analysis of the threatened flora’s distribution map in Aldamin-La Cruz pastureland of Gorbeia ZEC was done both in Araba’s and Bizkaia’s territories (2017), considering the slope-range (<30%, 30-50% and >50%) and grazing-category (forest, unproductive, scrub and pasture) as determinant factors for the grazing activity. In parallel, during 2021 grazing campaign, the main types of livestock were monitored (equine and sheep) by GPS, analyzing their behavior towards the mentioned factors. For that purpose, the time spent (GPS location register percentages) in the distribution zones of the 4 most abundant species of threatened flora (*Dihapsiastrum alpinum*, *Huperzia selago*, *Meum athamanticum* and *Ranunculus amplexicaulis*) was estimated.

Results. The observed threatened flora in Aldamin-La Cruz pastureland was mainly distributed within the categories of open pastures and scrubs and on >30% slope-ranges, especially on a 30-50% slope-range *Huperzia selago* and on >50% slope-range *Diphasiastrum alpinum*, *Meum athamanticum* and *Ranunculus amplexicaulis*.

The grazing behavior of the main livestock types (equine and sheep) showed that they spent significantly more time on <30% slope-range pastures. Even though no significant differences were observed for the two livestock types, equine livestock grazed longer on <30% slope-range pastures than sheep.

In relation to the threatened flora, the zones were *Ranunculus amplexicaulis* was present equine livestock showed a greater grazing-pressure than sheep, since the time spent was statistically higher.

Conclusions. In summary, actions for threatened flora conservation should consider the slope-ranges were different threatened species grow. Thus, threatened flora is more vulnerable to general grazing pressure on <30% slope-ranges, whilst on 30-50% slope-ranges the preferences of the livestock type may change. Thus, there is a need of the incorporation of a proportionate relationship between the type of animals, in addition to the stocking density, for the conservation of threatened flora.

Oral Presentation

Ecosystem engineering by Eurasian crane (*Grus grus*) in dry grasslands: conservation values, ecosystem services and disservices**Orsolya Valkó¹, Sándor Borza^{1,2,3}, Laura Godó¹, Zsolt Végvári⁴ & Balázs Deák¹**

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Aims. The Eurasian crane (*Grus grus*) is a large iconic bird species, protected across Europe, which, thanks to conservation programs and its ability to utilize croplands for foraging, shows a strongly increasing population trend. These large birds, similarly to other crane species are often involved in human-wildlife conflicts as they often forage in croplands and other agriculturally utilized areas. The increasing crane population exaggerates the already existing conflicts between farmers and cranes spilling over to natural habitats, where foraging by large flocks can substantially change grassland vegetation dynamics. However, the effect of large foraging crane flocks on grassland vegetation has not been studied so far.

Methods. Here we evaluated the effect of foraging cranes on the vegetation of dry grasslands in Hortobágy National Park, East-Hungary. We used indicators of vegetation naturalness, forage quality and floral resource provision to evaluate the ecosystem state from multiple aspects. We sampled 100 quadrats in disturbed patches and 100 in intact alkaline dry grasslands in two seasons (spring, summer) and two years (2020, 2021), resulting in a total of 800 observations.

Results. We found that foraging cranes created vegetation patches with different structure and species composition compared to undisturbed stands of dry alkaline grasslands. The disturbed patches were characterized by sparse vegetation with small cover but higher diversity of vascular plants and cryptogams. Although crane-disturbed patches could provide forage for livestock early in the season, the forage quality became poor later in the year. Crane-disturbed patches provided floral resources for a longer time and in larger quantity than undisturbed grasslands.

Conclusions. Our results suggest that the effects of foraging cranes from the conservation and rangeland management viewpoint are complex. We identified important trade-offs between the positive and negative effects of the foraging activity of cranes on different structural and functional components of the studied grassland ecosystems. The improved the ecosystem functioning by increasing diversity and floral resource provision but decreased the area of undisturbed alkaline grasslands. We suggest that a surveillance system monitoring the landscape-level extent of the disturbed areas, e.g., by satellite imagery would be important to keep track on the vegetation changes.

Poster Presentation

**Nature at home:
A public outreach project on bringing grassland species to gardens
to increase urban biodiversity**

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Aims. The mission of our project is environmental education by dissemination of knowledge, the practical involvement of participants and the analysis of social attitudes. Our project aims to bring nature closer to people, as a number of new research prove that a greener environment contributes to maintaining our physical and mental health. It is also becoming increasingly fashionable to decorate homes and courtyards of institutions with plants and flowers. We want to reach people through this 'fashion' and offer a nature-friendly alternative, that is, we can also decorate our environment with native plants.

Methods. We offer the seeds of native flowering plants from which people can choose and plant them at home. This way the participants can get one step closer to a nature-friendly home, kindergarten or school yard. People can choose seeds of five species from a set of 25 species native to Hungary that are characteristic of natural grasslands or extensively managed fields. We ask the participants about their preferences and the reasons for choosing the certain set of species in a questionnaire survey. We will study the trait spectrum of the most popular species which can help in designing native seed mixtures. We also establish sowing experiments in gardens of some participants and survey the establishment and flowering success of the model species in different soil types and different regions.

Results. The pilot year of the study (2021) showed that people are open to participate in this research and they are happy to use native plants in their gardens. With the help of the Scientific Mecenatúra funding, we can reach more people and increase the spatial coverage of our project in 2022 and 2023. We aim to reach approximately 2,000 people during the two years.

Conclusions. We hope that our project can increase social awareness and raise the profile of native plants as important components of urban biodiversity. We aim to give recommendations for a set of native plants that can successfully establish in gardens and offer an attractive alternative to non-native species.

Oral Presentation

**Restoring species-rich meadows on former agricultural land:
a practice-oriented long-term field experiment****Margot Vanhellemont, Joos Latré, An De Schrijver**

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Aims. Restoring or creating species-rich meadows on land used for agriculture is hard. High soil phosphorus concentrations promote competitive fast-growing species, and (seeds of) key meadow plant species are often absent at and around the restoration site. We set up a field experiment to show and explore the effects of different management measures aimed at reducing soil phosphorus and increasing species richness in order to advise practitioners in ecological restoration.

Methods. At 3 post-agricultural sites differing in soil phosphorus availability, 30 plots of 4 m × 5 m were marked out in spring 2017. We applied 10 treatments (3 replicate plots per treatment per site): 3 management measures (standard mowing, frequent mowing, sward removal) crossed with 3 re-introduction measures (seed of 19 key Arrhenaterion and Calthion species, green hay or soil of 6 reference meadows), and an additional management measure aimed at accelerated soil phosphorus reduction (phosphorus mining).

To quantify the effects of mowing with hay removal on soil phosphorus reduction, we measured dry biomass and phosphorus removal with the biomass at each mowing event (2017-2021) and soil phosphorus before the start of the experiment (2017) and after 5 years of mowing (2022). To evaluate effects of the re-introduction and management measures on plant species diversity, we made vegetation inventories in each plot (2017-2021).

Results. Biomass and phosphorus removal differed among management measures, sites and years. Overall, biomass and phosphorus removal were highest with phosphorus mining, at the site with the highest soil phosphorus availability and in the wettest year.

The number of key species increased with re-introduction, and the identity of the established key species differed among sites and re-introduction measures. At one site, frequent mowing led to higher key species richness than standard mowing.

Poster Presentation

Ecological peculiarities of *Stipo pulcherrimae-Festucetalia pallentis* communities in Ukraine (poster)Iuliia Vasheniak¹, Yakiv Didukh², Olga Chusova²¹ Vasyli' Stus Donetsk National University, Vinnytsia, Ukraine² M.G. Kholodny Institute of Botany, NAS of Ukraine, Kyiv, Ukraine

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Nine hundred and eight-nine relevés from calcareous petrophytic steppes in Ukraine and its adjacent territories were assessed with the help of expert systems to determine the syntaxonomic affiliation of the plant communities at class and order levels. At least 488 relevés belonging to the class *Festuco-Brometea* were analyzed using the TWINSpan algorithm, and 8 distinctive clusters were obtained, recognized as alliances of the order *Stipo pulcherrimae-Festucetalia pallentis*. A new alliance, *Bromopsido cappadocicae-Asphodelion tauricae*, was ascribed to the Crimean Mountains and the presence of two alliances, *Diantho lumnitzeri-Seslerion albicantis* and *Genisto tetragonae-Seselion peucedanifoliae*, was confirmed as new for this vegetation in Ukraine. Unlike in the Pannonian Basin, *Bromo pannonici-Festucion csikhegyensis* alliance communities mentioned in the literature do not occur in Ukraine. *Centaureo carbonatae-Koelerion talievii* has been provisionally transferred from *Festucetalia valesiaca* to the order *Stipo pulcherrimae-Festucetalia pallentis*. Furthermore, we distinguished alliances by their geographic locations and their climatic (thermoregime, cryoregime, light in communities) and edaphic (carbonate content, salinity, and acidity) features.

The DCA results show that the main factors affecting the vegetation diversity of studied petrophytic steppes are related to DCA1, acidity (Rc), cryoregime (Cr) and light in communities (Lc), the closest to DCA2 is nitrogen content (Nt), and to DCA3 are ombroregime (Om) and aeration (Ae). Other environmental factors play a smaller role in differentiation of the syntaxa. The right side of the ordination diagram contains alliances of arid communities: *Bromopsido tauricae-Asphodelion tauricae*, *Androsaco tauricae-Caricion humilis*, *Potentillo arenariae-Linion czernjaevii*, *Centaureo carbonatae-Koelerion talievii* from the steppe zone of Ukraine. The left side contains alliances of Central Europe and partly Eastern Europe: *Bromo pannonici-Festucion csikhegyensis*, *Diantho lumnitzeri-Seslerion albicantis*, *Genisto tetragonae-Seselion peucedanifoliae*, *Galio campanulati-Poion versicoloris* occurring mainly in the forest-steppe zone of Ukraine. The alliances *Potentillo arenariae-Linion czernjaevii* and *Centaureo carbonatae-Koelerion talievii* occupy a central position on the ordination diagram and this indicates that these alliances may be ecologically and floristically similar. We have to notice that *Diantho lumnitzeri-Seslerion albicantis* communities do not occur in Ukraine, although none of the relevés from the Volyn-Podillia Upland were included in the cluster with Polish relevés distinguished by the expert system as *Diantho lumnitzeri-Seslerion albicantis* alliance.

Oral Presentation

The effects of management on the biodiversity of riparian flood meadows in northwestern Finland**Stephen Venn**

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The Helmi (Pearl) programme was launched in 2020 as a national level government programme in Finland 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, many of which are classified as threatened. One of the predominant types of semi-natural grasslands in the region of Kainuu, in northwest Finland, is flood meadows, including dry flood meadows, with a sandy soil and diverse assemblages of forbs, and wet meadows, characterised by large grasses and sedges. In this study I focus on dry flood meadows, which are located along the riverbank, mostly on sandy soils. They have traditionally been cut by 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 37 sites along the Oulanka and Korouoma rivers under varying levels of management, was surveyed during 2020-2021. A total of 214 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. NMDS ordination was used to distinguish species assemblages of managed and unmanaged meadows and to look for other factors that affected the conservation value of these habitats.

Oral Presentation

Calcareous perennial dry grasslands and scrub of Southern Europe: syntaxonomical delimitation

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Question (Aims). Syntaxonomy of dry grasslands and scrub in Southern Europe is quite complex and still has numerous issues to unravel. There are many blurry boundaries between the vegetation units, especially in submediterranean areas, which is further complicated by the regional focus of most studies. We aim to delimit geographically, ecologically and floristically the calcareous perennial dry grasslands and scrub of Southern Europe on the level of vegetation classes.

Methods. The geographical scope of the project is Southern Europe including Portugal, Spain, France, Italy, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Kosovo, North Macedonia, Albania, Greece, Bulgaria and Turkey. We used the vegetation plots of calcareous perennial dry grasslands and scrub from the EVA database based on the vegetation class assignment (*Astragalo-Brometea*, *Carici-Genistetea lobelii*, *Daphno-Festucetea*, *Elyno-Seslerietea*, *Festuco hystricis-Ononidetea striatae*, *Festuco-Brometea*, *Lygeo sparti-Stipetea tenacissimae*, *Ononido-Rosmarinetea*, *Poetea bulbosae*, *Trifolio anatolici-Polygonetea arenastris*) and corresponding units of the EUNIS habitat classification. Altogether we collected 69,758 relevés from 15 countries. We used only relevés with plot area ranging from 9 m² to 100 m² and applied a geographically

stratified heterogeneity-constrained resampling. After taxonomic homogenization, we used different classification techniques (such as TWINSpan and fuzzy C-means).

Results. We obtained units interpretable as vegetation classes. Based on the results, we prepared clear floristic definitions with diagnostic species of phytosociological classes and developed an electronic expert system.

Conclusions. The high-level delimitation of the vegetation classes will help clarify the position of some syntaxonomical units and allow conducting classification studies at lower syntaxonomic levels. Moreover, as many of these vegetation types are vulnerable and endangered, our results might be a basis of proper conservation and management measures.

Poster Presentation

Diversity of mesic grassland in Polish Carpathians**Jan Zarzycki¹, Joanna Korzeniak²**¹ University of Agriculture in Krakow, Poland² Institute of Nature Conservation, Polish Academy of Sciences, Kraków, Poland

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Question. What is the diversity of plant species composition and species richness in semi-natural grasslands in the Polish Carpathians and what the main factors influenced this diversity?

Methods. A dataset of 1865 vegetation relevés sampled after year 2000 and containing 654 species of vascular plants was used for the analyses. This dataset was extracted from the phytosociological database 'Grasslands in the Polish Carpathians' after numerical classification and geographical resampling. The altitude and slope were used as topographic factors and the Ellenberg indicator values (F-moisture, R-soil reaction, N-soil fertility) as a proxy of habitat conditions. DCA was used for ordination of relevés and correlation with environmental conditions.

Results. The first 4 DCA axes together explained only 16.2% of the total variation. The length of main ecological gradient (DCA1 ax) was relatively short (3.426 SD) and explained 7.1% of the total variation and was negatively correlated with soil fertility (N) and soil reaction (R).

The species number per relevé ranged from 9 to 70 and the average was 33.9. The Shannon–Wiener index ranged from 1.1 to 3.9 and the average was 2.8. Both indexes were negatively correlated with soil fertility (N) and positively with altitude a.s.l.

The most frequent were common grassland species: *Achillea millefolium* (85%), *Rumex acetosa* (81%), *Ranunculus acris* (81%), *Veronica chamaedrys* (79%), *Plantago lanceolata* (79%), *Anthoxanthum odoratum* (76%), *Dactylis glomerata* (75%). Only 19 out of 654 species occurred with the frequency higher than 50%.

Conclusions. Species richness and plant species composition were affected mainly by habitat fertility and altitude. However, on such big area different factors can be decisive locally.

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