

15<sup>th</sup> Eurasian Grassland Conference

4–8 June 2018 - Sulmona (Italy)

COOPERATING FOR GRASSLAND CONSERVATION

Networking event of the Natura2000 Biogeographical process

Abstract Book



Ph. E. Giarrizzo



# Detailed program

## June 4th

- 14:30 - 15:00 Registration  
15:00 - 18:30 Workshop on preparing proposals for LIFE+ and INTERREG  
18:30 - 20:00 Welcome drink (registration will be possible)

## June 5th

- 9:00 - 9:40 Registration  
9:40 - 10:00 Greetings from local organizers and supporters  
10:00 - 10:40 **Keynote lecture** – Prof. Pietro Brandmayr “Carabid beetle assemblages in natural and seminatural grasslands of Italy: management and conservation”  
10.40 - 12.40 **Session 1 - Habitat classification and indicators of conservation status**  
*chairman Prof. Romeo Di Pietro*  
*Fortini P.* - Grassland Habitats in the montane areas of the Apennines. Conservation issues and syntaxonomic classification  
*Indermaur A.* - Key for determining the plant community types of the Swiss agricultural landscape  
*Giarrizzo E.* - Using vegetation dynamics to face the challenge of the conservation status assessment in semi-natural habitats  
*Glimskär A.* - Monitoring strategies and coordination challenges for evaluating grassland biodiversity and management in Sweden  
*Březina S.* - Monitoring the condition of montane meadows in the Krkonoše Mts against a pre-defined target status  
*Venn S.* - Insect assemblages of urban grasslands  
12.40 - 13.40 Lunch  
13.40 - 16.00 **Session 2 - Grasslands threats and pressures**  
*chairman Prof. Stephen Venn*  
*Ciaschetti G.* - Pasture changes in the Majella National Park (central Italy)  
*Lehmair T. A.* - Loss of diversity under protection - Vegetation changes since 1955 in a long term protected conservation area

*Straubinger C.* - 50 years of changes in the grassland vegetation of a South German floodplain

*Oddi L.* - Functional biodiversity is the key point of the interaction between climate and land-use change in a subalpine grassland

*Gheza G.* - Impact of an invasive herbivore and trampling on lichen-rich dry grasslands: soil-dependent response of multiple taxa

*Jakovels D.* - Mapping the spread of Sosnowsky's hogweed and overgrowing with shrubs in grasslands using remote sensing techniques

*Kovalenko O.* - Alien plant species in dry grasslands of the National park "Pyryatynskiy" (Ukraine)

16.00 - 16.40 Coffee Break

16.40 - 19.00 **Session 3 - Conservation goals and appropriate measures**

*chairman Prof. Agnes Van den Pol*

*Polchaninova N.* - Does summer fire affect autumnal complexes of steppe arthropods? A case study in northeastern Ukraine.

*Zlotnikova E.* - Destruction and natural reconstruction of reserved dry grassland: Fire vs. Plant interactions

*Görzen E.* - Burning and restoration from the seed bank – conservation perspectives for dry basiphilous grassland in Transylvania (Romania)

*Shang Z.* - Do human-engineering had evoked and guided the real ecological restoration of degraded grassland on Tibetan plateau?

*Napoleone F.* - Plant diversity and functions in semi-natural grasslands under different management intensities

*Janata T.* - LIFE CORCONTICA: project for a recovery of mountain farming using the adaptive management cycle tools incorporated into the LUHOP application

*Filibeck G.* - Multidisciplinary survey for integrated management in a subalpine grassland of high conservation relevance (Lazio Apennines, Italy)

**June 6<sup>th</sup>**

08:00 - 18:30 Mid-conference excursion

## June 7<sup>th</sup>

09:40 - 10:20 **Keynote lecture** – Dr. Prof. Jürgen Dengler “EDGG Field Workshops and the GrassPlot database: new opportunities to understand scale-dependent biodiversity patterns in Palaearctic grasslands”

### 10:20 - 12:40 **Session 4 - Setting conservation priorities**

*chairman Prof. Alessandro Chiarucci*

*Reisch C.* - The origin of dry grassland species in the context of conservation – postglacial migration routes and cryptic northern refugia

*Plenk K.* - Phylogeography and genetic diversity patterns in Pannonian and Western Pontic steppe grasslands as indicators for habitat conservation

*Jüriado I.* - Dry grasslands host high, previously unrecognized diversity of the genus *Peltigera* (lichenized Ascomycota) in Estonia

*Hilpold A.* - Decline of rare and specialized species across multiple taxonomic groups after grassland intensification and abandonment

*Marcantonio G.* - The LIFE project “FLORANET” for the conservation of endangered pasture plant species in three parks of central Italy

*Aleksanyan A.* - Rare Grassland Ecosystems: Classification and Conservation Issues in Armenia

*Baranova A.* - Impact of abiotic site factors on vegetation distribution of mountain pastures in Qilian Shan, NW China

12:40 - 13:40 Lunch

13:40 - 14:00 Transfer to National Park Operation Center

14:00 - 16:00 Knowledge market with coffee available

### 16:00 - 18:30 **Session 5 -Cooperating for grasslands**

*chaired by Biogeographical Process/WENR/ECOGest*

18.30 - 19.30 EDGG General Assembly (non-members have the possibility to visit to the Badia Morrone)

19.30 - 22.30 Grassland Party at the National Park Operation Center

## June 8<sup>th</sup>

08:00 - 18:30 Post-conference excursion (after the excursion the bus can take those participants that ask for it to Rome within 8 pm)

## Oral presentations

(Alphabetical order based on presenting author surname)

## **Rare grassland ecosystems: classification and conservation issues in Armenia**

Aleksanyan Alla, Fayvush Georgi

Department of Geobotany and Plant Eco-Physiology; Institute of Botany aft. A.L. Takhtajyan NAS RA

Presenting author: Alla Aleksanyan, [alla.alexanyan@gmail.com](mailto:alla.alexanyan@gmail.com)

### **Session 4**

**Question:** Armenia has extremely high diversity of species and ecosystems. This country possesses vast grassland resources (subalpine and alpine meadows, steppes, steppe-meadows, semi-deserts and deserts), which occupy the main part of territory and have special importance. Grasslands usually are used as pastures and hays, more often are affected by anthropogenic impact and need more attention and protection.

Ecosystems are extremely fast-changing elements of nature which under the influence of different factors can change the nature of vegetation, as well as the distribution and ratio of habitats. Taking into account this fact, the classification of grasslands is not simple but extremely important for modern ecology and nature conservation.

**Methods:** For classification of grasslands in Armenia have been used adapted EUNIS classification system, according on which you can find about 165 grassland habitats of different levels (Fayvush G. Aleksanyan A. "Habitats of Armenia", 2016). From which 85 have been described first time. From 2016 we are working on selection of rare grassland habitats and description of new ones.

**Results:** According to our last investigation in current stage for Armenia are highlighted 11 rare grassland habitats including: Steppes with wild wheat species dominance (E1.2E22-AM), Giant fennel – *Ferula* stands (E1.C4), Purple moorgrass – *Molinia* meadows and related communities (E3.51), Mountain feather-grass fescue steppes of Armenia (E1.2E13-AM), Wormwood semi-desert with *Iris lycotis* (E1.4511-AM), Grass meadow-steppes with *Acanthus dioscoridis* (E2.1611-AM), feathergrass-fescue steppes of Armenia (E1.2E13-AM), Saltwort semi-desert with

dominance of *Salsola dendroides* and *Cistanche salsa* (E1.3361-AM), *Pteridium tauricum* fields (E5.34-AM), Tall-herb communities of humid meadows (E5.424-AM), Alpine and subalpine fern stands (E5.5B). 8 are absent in the original scheme of EUNIS. They have limited distribution and in many cases include rare plant species, sometimes being the only habitat for them.

**Conclusions:** In case that 14% of territory of Armenia included in Natural Protected Areas, Ecological Network of "Emerald" the main part of these ecosystems are still out of conservation areas and measures. Based on our research will be published Red Book of Ecosystems and developed plan of measures for conservation of grasslands in Armenia. At the same time the list of grassland ecosystems will be updated.

## **Impact of abiotic site factors on vegetation distribution of mountain pastures in Qilian Shan, NW China**

Baranova Alina<sup>1</sup>, Schickhoff Udo<sup>1</sup>

<sup>1</sup> CEN Center for Earth System Research and Sustainability, Institute of Physical Geography, University of Hamburg, Germany

presenting author: Alina Baranova, [alina.baranova@uni-hamburg.de](mailto:alina.baranova@uni-hamburg.de)

### **Session 4**

**Question:** Environmental degradation of mountain pastures in Qilian Shan has increased in recent decades; soil erosion accelerated by extensive grazing is widespread. The aim of this study is to identify spatially differentiated grazing-induced changes in vegetation patterns and its relation to corresponding soil properties along the altitudinal gradient.

**Methods:** The study area is located in the spring/autumn and summer pastures in middle section of Qilian Mountains between 2600-3300 m.a.s.l., representing montane, sub-alpine and alpine plant communities modified by continuous grazing with sheep, goat and yak. Quantitative and qualitative relevé data were collected for vegetation classification and analysing of gradual changes in vegetation patterns along altitudinal gradient. Vegetation was classified using hierarchical cluster analysis and Indicator species analysis. Indirect multivariate ordination was used to analyse variation in relationships between the vegetation and corresponding environmental variables. ANOVA statistic, followed with post-hoc test, was applied to detect the differences between vegetation groups in environmental conditions.

**Results:** Five vegetation groups were identified: (1) sub-alpine shrubland, (2) montane xerophytic grassland, (3) montane mesophytic grassland, (4) degraded alpine shrubland, (5) alpine meadow. The results showed distinct variation in soil pH, bulk density, cation-exchange capacity (CEC), organic matter (OM), carbon, nitrogen and water content between the identified vegetation groups. Along the altitudinal gradient increase in soil conductivity, carbon, nitrogen, organic matter and water

content, and decrease in soil pH, CEC and basic saturation, were observed. Vegetation pattern, found on the south-exposed slopes in lower altitudes reveals the communities of montane grasslands with low concentrations of soil OM and soil minerals.

**Conclusions:** Impact of abiotic site factors on vegetation patterns is more pronounced on the alpine plant communities. Although all the pastures of Qilian Shan were exposed to extensive grazing, montane grasslands seem to experience more severe degradation in terms of vegetation cover, soil properties and mineral concentrations. Alpine meadow, also containing different indicators of disturbances, reveals comparatively low level of degradation. These findings outline the existing problems in Chinese pasture management, e.g. unequally distributed grazing pressure over the pastureland, resulting in overgrazing and land degradation.

## **Monitoring the condition of montane meadows in the Krkonoše Mts against a pre-defined target status**

Březina Stanislav<sup>1</sup>, Hrázský Zábaj<sup>2</sup>, Šturma Jan A.<sup>2</sup>, Čejková Alžběta<sup>1</sup>, Clive Hurford<sup>3</sup>

<sup>1</sup> Administration of the Krkonoše Mts National Park, Vrchlabí, Czech Republic

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<sup>3</sup> Orielton Field Centre, Pembroke, UK

Presenting author: Stanislav Březina, sbrezina@krnap.cz

### **Session 1**

We present an innovative concept of management monitoring originally developed by one of the co-authors of the presentation in Wales and then adapted for monitoring of montane meadows in the Krkonoše Mts in the frame of the project LIFE CORCONTICA. We consider management monitoring not only as surveillance of the current state of the protected feature, it is also comparing it with the desired pre-defined target status. To make this comparison, we must be able to define the state of the habitat using objectively verifiable and measurable indicators.

The core part of the presentation describes the development of measurable indicators of habitat condition to link with the desired state as presented in the conservation objectives in the management plan. More specifically, we demonstrate that an ideal indicator of the change in the state of a habitat can be a change in size of its best-preserved fragments. This change in size will be represented by a change in the number of sampling points in optimum condition on the transects, which run between preserved and degraded vegetation. This whole methodological approach is based on the repeatedly confirmed assumption that degradation of the vegetation is most often manifested by the spread of aggressive and invasive plants into the best-preserved species-rich vegetation, and that species-rich vegetation can be restored with the managed retreat of the competitive and invasive species. An increase in the number of plots

with best-preserved vegetation indicates appropriate management, while the opposite trend indicates a need to review it.

The presentation ends with description of main changes of meadows observed during the monitoring and summarises our current experience with this type of monitoring. We appreciate greater objectivity and representativeness of the data obtained, in comparison with the classic phytosociological surveying, as well as the speed of the data collection. An undeniable advantage of this type of monitoring is the possibility to link the vegetation monitoring with the establishment of management targets. Finally, it should be recognized that the described methodical approach was not developed to establish cause and effect, it was developed solely to provide an early warning of condition change.

## **Pasture changes in the Majella National Park (central Italy)**

Ciaschetti Giampiero, Angelucci Simone, Antonucci Antonio, Lapenna Maria Rita, Liberatoscioli Elena, Andrisano Teodoro

Majella National Park, Sulmona, Italy

Presenting author: Giampiero Ciaschetti,  
giampiero.ciaschetti@parcomajella.it

### **Session 2**

**Question:** Montane traditional economy suffered a decline during last decades in the Majella National Park like many other areas in Italy and Europe. The number of grazing heads on the pastures declined too and the species composition of them changed. On the other hand, wild herbivores have significantly increased, also due to the establishment of the Park. As a consequence, changes in plant landscape happened. Structure and species composition of the pastures changed too.

**Methods:** We analyzed past and actual data about human population, land cover, number and species of grazing livestock together with their management, number and species of wild herbivorous. Three type of pasture with different pressure and type of grazing are analyzed through phytosociological relevés: abandoned, moderately grazed by sheeps, overgrazed by cows.

**Results:** The data quantitatively show changes happened in Majella National Park in all the analyzed features. These are factors heavily influencing structure and species composition of the pastures. The three main pasture types recognizable accordingly to their use show evident differences both in structure and in species composition.

**Conclusions:** Pastures change accordingly with socioeconomic trends, changes in land cover, grazing livestock and wild herbivorous. So, their actual pattern is to be considered a complicated and dynamic reality which need to be careful managed.

## **Multidisciplinary survey for integrated management in a subalpine grassland of high conservation relevance (Lazio Apennines, Italy)**

Filibeck Goffredo, Cancellieri Laura, Mancini Leone Davide, Primi Riccardo, Ronchi Bruno

Department of Agricultural and Forest Science – University of Tuscia, Italy

Presenting author: Goffredo Filibeck, [filibeck@unitus.it](mailto:filibeck@unitus.it)

### **Session 3**

**Question:** The management of a high-elevation rangeland (1500 ha, at 1600-2200 m a.s.l.) in Abruzzo Lazio & Molise National Park (Central Apennines, Italy) poses intricate challenges, as the area hosts Natura 2000 habitat types, endemic wild herbivores (Apennine chamois), traditional sheep and goat co-grazing, and recently introduced free-ranging cattle. We asked: What are the spatial patterns of species diversity, composition and productivity? How can sustainable stocking load be estimated at a detailed spatial scale? What are the effects of different grazing regimes and loads on vegetation patterns? How can local stakeholders be involved in optimal management?

**Methods:** Vegetation composition and biodiversity were sampled through stratified random design. Productivity was assessed through NDVI obtained from high-resolution Sentinel 2 imagery, calibrated with standing biomass sampled in grazing exclosures. Sustainable stocking load was estimated at high spatial resolution by weighing productivity estimates with a forage value index based on botanical composition. Grazing regime and load were assessed through faecal pellet group count and GPS radio-collars.

**Results:** Floristic composition and diversity feature a high variability and a highly complex spatial pattern. Productivity, and hence sustainable stocking rate, shows dramatic variability both in space and time. Traditional co-grazing of sheep and goats appears to be highly beneficial to floristic diversity, priority habitat types and forage value, while cattle grazing seems to enhance invasion of unpalatable species. Abandonment leads to rapid encroachment of subalpine shrubs.

**Conclusions:** Co-grazing of sheep and goats is a traditional practice that survives only in very few areas of the Apennines, yet it seems to be highly beneficial to floristic diversity, forage value stability and Natura 2000 habitat conservation. In the study area, co-grazing survives thanks to the production of a local type of cheese, requiring a mixture of sheep and goat milk. Inter-annual variability in primary productivity has to be taken into account in sustainable management. Engagement of local shepherds and authorities is thus essential, in order to promote ancient practices and at the same time integrate them in a science-driven monitoring framework.

## **Grassland Habitats in the montane areas of the Apennines.**

### **Conservation issues and syntaxonomic classification**

Fortini Paola<sup>1</sup>, Ciaschetti Giampiero<sup>2</sup>, Di Pietro Romeo<sup>3</sup>

<sup>1</sup> Museo Erbario, Department of Bioscience and Territory, University of Molise, Pesche (Italy).

<sup>2</sup> Majella National Park, Sulmona (Italy)

<sup>3</sup> Department of Planning, Design and Architecture Technology, Section of Environment and Landscape, Sapienza University of Rome (Italy).

Presenting author: Paola Fortini, fortini@unimol.it

### **Session 1**

**Question:** According to the Interpretation Manual of European Union Habitats (EUR 28 vers.) the habitat 6210 is composed of grasslands ranging from those steppic or subcontinental (*Festucetalia valesiaca*) to those more oceanic and sub-Mediterranean (*Brometalia erecti*). The *Festucetalia valesiaca* grasslands are absent in the Apennines, while the *Brometalia erecti* grasslands are quite common and include a wide pattern of communities. The original syntaxonomic reference to the primary *Xerobromion* grasslands and the secondary *Mesobromion* grasslands provided by the EUR28 Manual broadens considerably when it is declined for the Apennines where several endemic syntaxa have been proposed (see the Italian Interpretation Manual of the 92/43/EEC Habitat Directive). However, the “National/local” approach which follows the Italian Prodrôme of Vegetation (Biondi et al. 2014) significantly differs from the recent Eurovegchecklist. So first question is: what could be the consequences of this syntaxonomical inconsistency between these two syntaxonomical frameworks on the 6210 Habitat interpretation?

At a lower scale we have analysed the Italian *Brachypodium rupestre* communities try to answer to the following question: are they referable to the 6210 Habitat? This question arises spontaneously considering that these communities are normally related to post-cultural environments,

forest clearances and abandoned pastures and that their occurrence is often viewed as a “negative” turn of the dynamical successions.

**Methods:** A survey of the main syntaxonomical frameworks published for the Italian peninsula and Europe have been analysed and critically interpreted. A phytosociological analysis of the *Brachypodium rupestre* grasslands of the Appennino Lucano National Park have been done and compared with the other *B. rupestre* communities described for the Italian Peninsula so far.

**Results and Conclusions:** The results emerged from this study are the following: At national level the moving of the most of the montane Apennine dry grasslands from *Festuco-Brometea* to *Festuco-Ononidetea* as proposed by the Eurovegchecklist could have consequences in the interpretation of habitat 6210. As regards *Brachypodium rupestre* communities, this study has demonstrated that at least some *B. rupestre* grasslands are characterized by a high number of species per relevé and a simultaneous high occurrence of rare orchids.

## **Impact of an invasive herbivore and trampling on lichen-rich dry grasslands: soil-dependent response of multiple taxa**

Gheza Gabriele<sup>1</sup>, Assini Silvia<sup>1</sup>, Marini Lorenzo<sup>2</sup>, Nascimbene Juri<sup>3</sup>

<sup>1</sup> Department of Earth and Environmental Sciences, University of Pavia, Pavia, Italy.

<sup>2</sup> DAFNAE Department, University of Padova, Legnaro (PD), Italy.

<sup>3</sup> Department of Biological, Geological and Environmental Sciences, University of Bologna, Bologna, Italy.

Presenting author: Gabriele Gheza, gheza.gabriele@gmail.com

### **Session 2**

**Question:** Dry grasslands are listed among the habitats of conservation concern according to the Habitat Directive. The impact of small-scale disturbance on these habitats has not been fully investigated, especially in the Po Plain, where it could represent a threat especially for lichen-rich grasslands. In this study we addressed the following questions: (1) do human trampling and disturbance by herbivores impact this habitat? (2) Does this impact vary at the variation of soil pH?

**Methods:** Based on a multitaxon approach including vascular plants, bryophytes and lichens, we explored the effects of small-scale disturbance on lichen-rich dry grassland vegetation by surveying 60 sites across the Po Plain (Northern Italy). We evaluated the impact of human trampling and grazing by the alien invasive herbivore *Sylvilagus floridanus* by recording species composition and cover of the three taxa, soil pH and environmental variables (mean annual precipitation and disturbance types) in 185 circular plots (radius = 3 m). Data were analyzed through GLMs considering the environmental variables alone and their interactions with soil pH as predictors of cover and species richness of the three taxa.

**Results:** We found a soil-dependent response of multiple taxa to the impact of the herbivore. For plants, beside a negative effect of trampling, the interaction between *Sylvilagus* fecal pellet amount and soil pH indicates that the negative effect of the invasive herbivore is stronger on

acidic soils. Bryophyte cover increased with increasing soil pH, annual rainfall and fecal pellet, while it was not affected by trampling. Lichen richness and cover decreased with increasing soil pH. The interaction between soil pH and fecal pellet indicates that the more negative effects on lichens should be expected on calcareous soils. Trampling did not affect lichen patterns and the rainfall gradient marginally affected lichen cover with a negative effect.

**Conclusions:** The main implications of this study for improving conservation are: (1) conservation practices should be tailored to organism and substrate type; (2) bryophyte and lichen diversity patterns are influenced also by climatic conditions, suggesting that the impact on these organisms may be exacerbated by climate change; (3) strict conservation, even though active exclusion of wild fauna, of the most species-rich sites should be recommended.

## **Using vegetation dynamics to face the challenge of the conservation status assessment in semi-natural habitats**

Carli Emanuela<sup>1</sup>, Giarrizzo Eleonora<sup>1</sup>, Burrascano Sabina<sup>1</sup>, Alós Ortí Marta<sup>2</sup>, Del Vico Eva<sup>1</sup>, Di Marzio Piera<sup>3</sup>, Facioni Laura<sup>1</sup>, Giancola Carmen<sup>3</sup>, Mollo Barbara<sup>1</sup>, Paura Bruno<sup>4</sup>, Salerno Giovanni, Zattero Laura<sup>1</sup>, Blasi Carlo<sup>1</sup>

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<sup>2</sup> Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Tartu (Estonia),

<sup>3</sup> Dept. of Bioscience and Territory, University of Molise, Pesche (IS),

<sup>4</sup> Dept. of Agricultural, Environmental and Food Sciences, University of Molise, Campobasso,

Presenting author: Eleonora Giarrizzo, [eleonora.giarrizzo@uniroma1.it](mailto:eleonora.giarrizzo@uniroma1.it)

### **Session**

1

**Questions:** European semi-natural dry grasslands are among the most species-rich ecosystems globally, but they are being degraded at very high rates due to land-use changes. Therefore, as required by the European Habitats Directive, urgent conservation measures should be based on a sound conservation status assessment.

We aimed to: i) define a set of effective indicators for the conservation status assessment and an easy methodology to combine them in the degree of conservation assessment of the habitat 6210; and ii) test the consistency of the status categories we identified with the occurrence of species of conservation concern.

**Methods:** Through mixed effect models, we tested ten potential indicators, encompassing proxies of species composition, habitat structure, and landscape patterns, against a measure of compositional change from habitat favourable condition. This measure derives from the re-visitation of 132 sampling units along the Apennines historically sampled between 1966 and 1992. It was quantified as the dissimilarity between the historical habitat species pools and the composition of the current communities. To test the meaning of our assessment in a species

conservation perspective we calculated the average number of species of conservation concern in the groups of sampling units assigned to different status categories.

**Results:** The number of habitat diagnostic species and the relative cover of woody species were significantly related to the compositional change with opposite signs (positive and negative, respectively). We classified and combined the classes of these two indicators in each sampling unit to assess the habitat conservation status at the plot level. Our assessment was in good agreement with the occurrence of species of conservation concern.

**Conclusion:** The conservation of semi-natural habitats represents a primary challenge in European nature conservation due to their great species diversity and their vulnerability to the ongoing massive land-use changes. Here we develop a methodological strategy for the conservation status assessment of semi-natural grasslands based on well-defined criteria, and we tested the possibility of using re-visitation not only to measure the degree of change to which grasslands have been subjected to, but also to identify effective indicators for future monitoring activities.

## **Monitoring strategies and coordination challenges for evaluating grassland biodiversity and management in Sweden**

Glimskär Anders

Department of Ecology, Swedish University of Agricultural Sciences (SLU)

Presenting author: Anders Glimskär, anders.glimskar@slu.se

### **Session 1**

**Question:** In Sweden, a set of monitoring programmes are currently being developed for evaluating grassland biodiversity. How can monitoring designed for specific purposes be combined, to increase the generality and usefulness, in response to new requirements from society and new challenges to environment and biodiversity?

**Methods:** The current methods for monitoring of grasslands in Sweden include both registration of plant species and variables for vegetation structure and management in permanent sample plots. It allows analysis of plant species richness and composition, but also management and environmental effects on vegetation structure and habitat quality.

The most extensive monitoring programme was started in 2006, based on a sample from a database comprising over 70000 sites of the *National Survey of Pastures and Meadows* (NSPM). Other recent monitoring schemes use visual interpretation in 3D of high-resolution false-colour infrared aerial photographs to map grassland vegetation in much detail. The aim is to combine extensive field inventory with full-cover mapping at the landscape scale, as well as for particular grassland habitats.

**Results:** Experiences from ten years of nation-wide monitoring show that the challenges in adapting design and methods to a variety of purposes and grassland types are considerable. One study has used data from the NSPM monitoring for evaluating agri-environmental payment schemes for grassland management and biodiversity. However, we now know that the amount of grasslands outside the NSPM database are much larger than previously known. This can impose a potentially severe sampling bias, since previously well-documented grassland may have more positive (or less negative) trends. We now explore how monitoring

for EU Habitats Directive can be used to alleviate this bias, but at the same time be optimized for habitat reporting.

**Conclusions:** Our results exemplify the challenge in extracting general results from several monitoring schemes developed for different purposes. Methods for combining different datasets must be developed, but also strategies to stream-line and adapt monitoring schemes for various requirements.

## **Burning and restoration from the seed bank – conservation perspectives for dry basiphilous grassland in Transylvania (Romania)**

Görzen Eugen<sup>1</sup>, Borisova Karina<sup>1</sup>, Fenesi Annamária<sup>2</sup>, Ruprecht Eszter<sup>2</sup>, Donath Tobias W.<sup>1</sup>

<sup>1</sup>Department of Landscape Ecology - Christian-Albrechts-University Kiel (Germany)

<sup>2</sup>Hungarian Department of Biology and Ecology, Babeş-Bolyai University Cluj-Napoca (Romania)

Presenting author: Eugen Görzen, egoerzen@ecology.uni-kiel.de

### **Session 3**

**Questions:** Transylvanian dry basiphilous grasslands are of global importance in terms of high plant species diversity, but recent land abandonment in peripheral areas puts them at risk. In order to halt secondary succession and the establishment of native and non-native woody species, prescribed burning of shrub encroached grassland has recently been intensified. Little is known about the specific effects of encroachment by native and non-native woody species and burning on vegetation and soils in Transylvania's non-fire-prone grasslands, and there is a lack in efficient measures to restore encroached grassland. We ask: (i) how do woody species establishment and prescribed burning influence plant species composition and soils, (ii) do native and non-native woody species differ with respect to their impact on grassland species composition and structure, (iii) is controlled burning useful to control woody species encroachment and to preserve biodiversity of these grasslands, and (iv) can soil seed banks contribute to the restoration of dry basiphilous grasslands in Transylvania?

**Methods:** We collected data on vegetation- and seed bank composition and soil conditions in 16 shrub encroached grasslands in Transylvania and adjacent un-encroached grassland. Data were analyzed with regard to the impacts of woody species encroachment (native vs. non-native species) and fire on grassland vegetation, soil and seed bank. We used NMDS for visual exploration of the datasets and LME-Models combined with ANOVA and Tukey contrast tests for inferential statistics.

**Results:** Woody species encroachment was accompanied by a decrease in plant species diversity and altered soil conditions. We found no difference in effect size between native and non-native woody species on tested vegetation-, soil- or seed bank parameters. While the effects of fire on vegetation and soil were weak compared to the effects woody species encroachment, burning failed to reduce the cover of woody species sustainably. Grassland vegetation and the seed bank differed significantly in species composition and diversity, indicating a limited potential for restoration from the seed bank alone.

**Conclusion:** There is an urgent need for further research and the development of locally adapted, sustainable and cost-effective management practices to preserve grassland diversity in Transylvania.

## **Decline of rare and specialized species across multiple taxonomic groups after grassland intensification and abandonment**

Hilpold Andreas<sup>1</sup>, Seeber Julia<sup>1,2</sup>, Fontana Veronika<sup>1</sup>, Niedrist Georg<sup>1</sup>, Steinwandter Michael<sup>1</sup>, Tasser Erich<sup>1</sup>, Tappeiner Ulrike<sup>1,2</sup>

<sup>1</sup> Institute for Alpine Environment, Eurac Research, Bolzano/Bozen, Italy

<sup>2</sup> Institute of Ecology, University of Innsbruck, Innsbruck, Austria

Presenting author: Andreas Hilpold: andreas.hilpold@eurac.edu

### **Session 4**

**Question:** Traditionally managed dry grasslands are declining as a result of abandonment or intensification of management. We want to know if the share of rare and specialist species is smaller in abandoned or intensified areas, which organism groups show the largest differences, and if we find similar patterns for species richness for each taxonomic group.

**Methods:** We investigated species compositions of 16 taxonomic groups on traditionally managed dry pastures and compared them with compositions on more intensively used (i.e. fertilized and irrigated hay meadows) and abandoned grasslands (larch forests). In contrast to many similar biodiversity studies, we included both faunal above- and belowground biodiversity.

**Results:** The larch forests showed the highest species number (345 species), with slightly less species in pastures (290 species) and much less in hay meadows (163 species). The proportion of rare species was highest in the pastures and lowest in hay meadows. Similar patterns were found for specialist species, i.e. species with a narrow habitat specificity. After abandonment, larch forests harbor a higher number of pasture species than hay meadows.

**Conclusions:** Both abandonment and intensification have similar negative impacts on biodiversity. The study stresses the high conservation value of Inner-Alpine dry pastures.

## **Key for determining the plant community types of the Swiss agricultural landscape**

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### **Session 1**

**Question:** For monitoring programs it is crucial to produce repeatable results when determining the study object. That is often relatively simple when monitoring species, but more challenging when monitoring plant communities.

**Method:** To cope with this challenge, we developed a key for plant community types. The development of this key is based on expert knowledge and a refinement by thorough testing and readjusting of the key in the field all over the country. The key is binomial, hence, for each step one of two possibilities has to be chosen, based on physical properties of the plot, single plant species, species groups or land use.

The key follows an existing plant community classification, which is widely accepted and used in nature conservation in Switzerland. It distinguishes 86 habitats of the agricultural landscape in a wider sense, among which are several grassland types, ranging from alpine pastures to bogs and dry meadows, and from highly managed to natural. The classification roughly corresponds to the EUNIS habitat classification level 4.

**Results:** To test the reproducibility of the classified habitats, we have done repetition surveys of the same vegetation relevés. The habitat key showed a high reproducibility of plant community assignment – but only when it is used by skilled botanists and when our guidelines were strictly observed.

**Conclusion:** One future goal is to subdividing the fertilised meadows, which are highly heterogeneous and make up a large part of the Swiss agricultural landscape.

## **Mapping the spread of Sosnowsky's hogweed and overgrowing with shrubs in grasslands using remote sensing techniques**

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### **Session 2**

**Question:** Abandonment of grasslands usually result in the overgrowing with shrubs as well as spread of invasive species. Sosnowky's hogweed has been introduced in Latvia in late 1940s as a fodder plant and has become a serious invasive threat to grassland biodiversity. It has been reported that 70-90% of EU importance grassland habitats in Natura 2000 sites were in poor condition in Latvia during 2012. There is a clear interest for assessment and monitoring of grassland status. The Integrated Planning tool was developed in frames of LIFE+ project "Integrated planning tool to ensure viability of grasslands" (LIFE Viva Grass <https://vivagrass.eu/>) in order to prevent loss of high nature value grasslands and increase sustainability of semi-natural grassland management. One of the main questions was:

What are the possibilities and limits for automatic mapping of the spread of invasive species (Sosnowsky's hogweed) and overgrowing with shrubs in grasslands using remote sensing techniques?

**Methods:** Remote sensing (airborne and satellite) techniques provide large area coverage in short time and possibility of automatic data processing. Airborne data acquired with flying laboratory ARSENAL was used for mapping of the spread of Sosnowsky's hogweed and overgrowing with shrubs in grasslands of Cesis Municipality in Latvia. ARSENAL is a constellation of optical and thermal hyperspectral imagers, topographic LiDAR sensor and high-resolution color camera. Additionally, the usability of multispectral Sentinel-2 satellite data was also studied.

**Results:** High accuracy (>90%) was obtained for both classification tasks – mapping the spread of Sosnowsky's hogweed and overgrowing with

shrubs in grasslands using airborne remote sensing techniques. It was also demonstrated that multispectral Sentinel-2 satellite data is useful for mapping of large stands (limited to 20 m image pixel size).

**Conclusions:** Remote sensing has shown to be useful and effective approach for automatic mapping of the spread of Sosnowsky's hogweed and overgrowing with shrubs in grasslands in a wider area.

**LIFE CORCONTICA - project for a recovery of mountain farming using the adaptive management cycle tools incorporated into the LUHOP application.**

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**Session 3**

**Question:** The history of the Krkonoše Mts montane meadows dates back to the middle of the 16th century. 400 years of development were interrupted by displacement of a large part of the original German-speaking population. The meadows were abandoned or included in the centralized socialist system. Since a change in political conditions and consequent socio-economic changes at the end of the 1990s, the economy has gradually recovered.

**Methods:** The LIFE CORCONTICA multidisciplinary project was implemented in the Krkonoše Mts National Park, SCI Krkonoše, in the years 2012–2018. The main objective of the project was restoration of Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (6230 \*), the support of the dwarf gentian\* population (*Gentianella praecox* subsp. *bohemica*) and the accessibility of watercourses for the bullhead (*Cottus gobio*).

The project facilitated return of farmers to the meadows, created the conditions for regular care by cuttings trees, rehabilitation of the water regime, stones collection, fertilization, etc. New farmers were connected with landowners and the agreed management measures were realized. The measures were incorporated in a 3–5 years' management plans and resulted from previous analysis of objects of protection and management goals. For planning, implementation and evaluation of project interventions new principle of the Adaptive Management Cycle has been introduced. New style of work with informations and new processes were formalised in the newly created LUHOP application database. On the LUHOP platform, we can work with map data, get an

overview of the occurrence and conditions of objects of protection, prioritize conservation activities, specify management goals, set an optimum management plan, collect data from monitoring, and evaluate effectiveness of our activities through audits.

**Conclusions:** The LIFE CORCONTICA project was an essential tool for nature conservation in the Krkonoše Mts. LUHOP based on Adaptive management cycle will be a strong tool for improving conditions of priorities of national park.

## **Dry grasslands host high, previously unrecognized diversity of the genus *Peltigera* (lichenized Ascomycota) in Estonia**

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### **Session 4**

**Question:** Lichenized fungi (lichens) are ecologically important in many terrestrial ecosystems, including grasslands. In this study we focus on the diversity of widespread foliose cyanolichen genus *Peltigera* in natural and semi-natural habitats in Estonia. The genus *Peltigera* (Peltigeraceae, Ascomycota) includes mainly terricolous and muscicolous species and many of them are poorly delimited and/or undescribed.

**Methods:** The study sites were distributed all over Estonia and included three different wooded habitat types (oligotrophic forests, eutrophic forests, and park stands) and three different grassland types (alvars, dunes, and roadsides). Internal Transcribed Spacer (ITS) sequences of the fungal symbiont were amplified from *Peltigera* specimens.

**Results:** Phylogenetic analyses of the ITS sequences revealed considerable previously unrecognized diversity especially within the *Peltigera* section *Peltigera*. The diversity of *Peltigera* was the highest on road verges and dunes and the lowest in alvar habitats which, however, supported a unique assemblage of undescribed *Peltigera* taxa.

**Conclusions:** The results demonstrate that in Estonia, many *Peltigera* species have narrow habitat requirements and are at present threatened by habitat loss and degradation.

## Alien plant species in dry grasslands of the National park “Pyryatynskiy” (Ukraine)

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### Session 2

**Question:** Dry grasslands are important reserve of the species diversity of the National park “Pyryatynskiy”. However, it is one of most endangered type of vegetation. Successful conservation of dry grassland is impossible without its complex study that must include extended investigation of alien plant species as a powerful danger for ecosystem structure.

**Methods:** We presented data of original research of dry grassland of national park in 2008-2017. We sampled more than 460 full fitosociological releves and analyzed it in the programs Vegclass. v. 1.0 and JUICE. Cluster analysis was made by Statistica for Windows (StatSoft).

**Results:** We determinate 53 alien plant species in communities of dry grasslands in the National park “Pyryatynskiy”. In xerothermic meadows on sandy soils (order *Galietaalia veri*) we found 28 non-native species, communities of steppes (*Festuco-Brometea*) have 26 alien species. For other types of dry grasslands in rhe national park we stated lower number of alien plants. Sandy steppes (*Festucetea vaginatae*) represent 21 adventive species, xerothermic forest-edge communities (*Melampyro pratensis–Holcetalia mollis*, *Origanetalia vulgaris* and *Antherico ramosi-Geranietalia sanguinei*) includes 20 alien plant species.

The lower number of adventization is 6,5 % for communities of class *Trifolio-Geranietea*. In other dry grasslands relative quantity of alien plants is 10.2-12.7 %. Cluster analysis shows the most similarity of alien species fraction of communities *Festuco-Brometea* and *Galietaalia veri* (Sørensen–Dice index is 0.054). *Trifolio-Geranietea* communities have the most unique fraction of alien species.

The most aggressive alien plant species for dry grasslands of National park "Pyryatynskiy" is *Phalacrolooma annum* (L.) Dumort., *Conyza canadensis* (L.) Cronq., *Ambrosia artemisiifolia* L. and *Asclepias syriaca* L.

**Conclusions:** Alien plant species of dry grasslands of National park "Pyryatynskiy" are preferable kenophytes with North American or Mediterranean origin. The invasive success is mainly due to active generative and vegetative reproduction, wide ecological amplitude, efficient use of environmental resources. To limit the further spread of invasive species and mitigate the effects of their introduction, we offer a number of measures.

## **Loss of diversity under protection - Vegetation changes since 1955 in a long term protected conservation area**

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### **Session 2**

**Questions:** Since the 1950s, land use change caused an ongoing decline of semi-natural grassland within the agricultural landscape of Central Europe. Before this abandonment of traditional land use, the study area was phytosociologically analyzed by Otti Wilmanns in 1955. Based on this work we reevaluated the remaining calcareous grasslands and oat grass meadows in 2015, to answer the following questions:

- (i) Did vegetation or species composition change since 1955?
- (ii) What is the distribution of phytosociological communities in 1955 and today?
- (iii) Did management, environment or even both cause any shifts?

**Methods:** The study area is located on the Swabian Alb (Baden-Wuerttemberg, Germany) and contains the conservation area “Gereuthau”, which was already established in 1938. We compared historical and current phytosociological maps, as well as land use maps, to illustrate spatial and temporal changes within the study area. Additionally, we analyzed the development of vegetation and plant communities over the last 60 years by evaluating quantitatively averaged management and Ellenberg indicator values. Further, we examined the actual environmental conditions on the basis of soil chemical and physical parameters, reflecting local field management.

**Results:** During the last 60 years, 23 % of the grassland (communities) were replaced by fallows and forests. The number of species, especially of the currently endangered ones, decreased in both, oat grass meadows and calcareous grasslands. Further, the homogenization of fodder and

grazing tolerance values, as well as soil moisture and nitrogen indicator values constituted a gradual loss of habitat diversity.

**Conclusions:** The vegetation and plant communities changed since 1955, due to intensification and abandonment. In oat grass meadows high cutting frequencies and the use of fertilizer resulted in a unified species composition, while abandonment and resulting eutrophication transformed calcareous grassland communities. Further, nitrogen as fertilizer or atmospheric deposition had a lasting effect on the environmental conditions. The current habitat quality within the study area, therefore, was mainly affected by changed land use and increased nitrogen input.

## The LIFE project “FLORANET” for the conservation of endangered pasture plant species in three parks of central Italy

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### Session 4

**Question:** What concrete actions can we do to enhance the conservation status of threatened species linked to pastures? On the basis of the actual state of implementation of the Life Project 15 NAT/IT/000946 «FLORANET», are the results obtained up to now useful for this purpose?

**Methods:** Several actions are played out to enhance the conservation status of three plant species of annexes II and IV of the Habitat Directive that are linked to pastures: *Astragalus aquilanus* Anzal.; *Jacobaea vulgaris* Gaertn. subsp. *gotlandica* (Neuman) B.Nord; and *Iris marsica* I.Ricci & Colas. Detailed populations analyses are carried out including also genetic analyses that are necessary to better distinguish *Iris marsica* from the very similar and complicated ‘species’ *I.ris germanica* L. Manual pollination of *Cypripedium calceolus* is made to increase its very scarce fruiting. Seed collection and stocking, together with analysis of their germination ecology are needed for nursery seedling reproduction. Those seedlings will be used to make restocking actions on very small

populations. Field interventions comprising protection of some populations and habitat management are ongoing too.

**Results:** The actual implementation state of the conservation actions foreseen by the project is presented here. At this time, about half of the population analysis was performed and the genetic analyses of the *Iris* populations are almost completed. Manual pollination of *Cypripedium calceolus* was made in June 2017 with good results on fruiting. Seed lots were accessed in two seed banks: first germination analysis have been performed on *Astragalus aquilanus* and *Jacobaea vulgaris* subsp. *gotlandica* with high percentage of germination while they are still ongoing on *Iris marsica*. Cultivation of seedlings is ongoing with good results up to now on all the three species. Some of the field interventions concerning protection of populations, habitat management and restocking were done while others have been just planned and others are going to be planned.

**Conclusions:** The conservation actions of the Life Project 15 NAT/IT/000946 «FLORANET» made up today allowed a better knowledge on the populations of the three threatened species, their seed germination ecology and their cultivation. Stocking seeds in the seed banks and cultivating seedlings in the nursery, beside the *ex-situ* conservation, allow to have living material for the restocking operations. Field interventions are still ongoing.

## **Plant diversity and functions in semi-natural grasslands under different management intensities**

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### **Session 3**

**Question:** Main aims of this study are: i) assess the relationships between plant diversity and ecosystem services such as forage for livestock and support to insect pollinators; ii) define compositional, structural and functional traits that indicate a high pastoral value and support to pollinators; iii) identify the management practices that better combine biodiversity conservation and ecosystem functionality.

**Methods:** The study focuses on the 6210(\*) habitat: semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (\*important orchid sites). Study area includes the Central Apennines and the North-Western Alps. The sampling design is based on management data, sampling units are randomly located in patches subjected to different grazing regimes and in abandoned areas. Vascular plant species composition will be recorded together with information on topography and soil. For each sampling unit we will calculate the pastoral value and the degree of support to insect pollinators as well as the habitat degree of conservation in order to relate these parameters to different management regimes.

**Results:** We expect that a higher plant diversity relates to a higher pastoral value and support for insect pollinators and that these positive ecosystem properties are associated with low stocking rates.

**Conclusions:** Identifying the management practices causing a high degree of conservation for the habitat and maintaining its functions is essential to achieve good governance models.

## **Functional biodiversity is the key point of the interaction between climate and land-use change in a subalpine grassland**

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### **Session 2**

**Questions:** Climate and land-use change have the potential to produce a shift in the role of grasslands from C sinks to C sources, especially in alpine ecosystems that are ecologically sensitive. This study aims to: (i) monitor the inter-annual variability in LAI and biomass production in a subalpine grassland, focusing on the different responses of grasses and forbs; (ii) describe structural changes of plant community after nine years of grazing exclusion; (iii) investigate the interaction between ecosystem structure and responses to climate change, focusing on temporal stability.

**Methods:** The study area is located on the western Italian Alps, in Aosta Valley and is occupied by a subalpine grassland dominated by *Nardus stricta*. Three different plots (600 m<sup>2</sup>) were identified within the area, two inside a fence excluding grazing and the third outside and still occasionally grazed. Biomass samples were collected every ~10 days and then manually sorted in grasses, forbs and 'others'. Fresh sorted samples were scanned to calculate the LAI of each functional type, and then oven dried and weighted. Finally, two vegetation surveys were carried out in 2009 and 2017 following the point transect method.

**Results:** The observed high variability in snow cover duration, precipitation, and air temperature among years led to a high variability in LAI and biomass production, which were negatively affected by the heat waves occurred in 2015 and 2017. Differently to grasses, forbs biomass was not affected by drought or showed even higher values.

Moreover, the three plots showed different levels of temporal stability during the heat waves. A general trend in plant community structure toward forbs dominance and higher biodiversity was observed, with different patterns in the three plots.

**Conclusions:** The high variability among different seasons showed that climatic drivers may cause direct changes of the growing season pattern even in a short period. Since forbs and grasses responded differently to climatic conditions, we suggest that the different stability of the three plots depended on the dominance of different functional types. In this framework, land-use changes affecting the structure of subalpine grasslands may have a role in the ecosystem responses to climate change.

## **Phylogeography and genetic diversity patterns in Pannonian and Western Pontic steppe grasslands as indicators for habitat conservation**

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### **Session 4**

**Questions:** In the last century, the area of steppe grasslands has decreased tremendously due to changing land use. The remaining patches of dry grassland sites are important refuges for many rare species and therefore, are of high importance in nature conservation. However, little is known about their biogeographical history and the local continuity of their species composition; factors which are important for effective preservation of species richness and genetic diversity. Potential source areas for the (re-)colonisation of the Pannonian region from glacial refuge areas are assumed in the Western Pontic region, along the Black Sea coast and/or on southern slopes surrounding the Hungarian Plain.

We ask if characteristic steppe grassland species, representing mostly rare habitats in Central and Southeastern Europe, show varying patterns of genetic structure and diversity, i.e. a diverging response to glacial survival, postglacial expansion and/or recent decline.

**Methods:** In a preceding classification of Pannonian *Festuco-Brometea* grasslands, characteristic species of *Brometalia erecti*, *Festucetalia valesiaca*, and *Stipo-Festucetalia pallentis* were determined based on a comprehensive set of relevés. We selected 12 character species for our cpDNA sequence analyses, to investigate their phylogeographical structure and genetic diversity. Here, we compare results of one representative from each of the three main dry grassland orders.

**Results:** We identified different patterns of intraspecific genetic structure and diversity throughout the Pannonian and Western Pontic region for *Filipendula vulgaris*, *Astragalus onobrychis*, and *Linum tenuifolium*. The latter two species represent the Pannonian and Western Pontic steppe grasslands as distinct units, harbouring high and moderate haplotype diversity, respectively. In contrast, *F. vulgaris* showed less genetic structuring between the two regions and accordingly also overall low diversity.

**Conclusions:** Results obtained for these three species indicate, that patterns of genetic diversity and phylogeographical structure of steppe species differ between the grassland orders investigated. However, further analyses of 2-3 additional species per group will reveal a more detailed picture of potential refuge areas and migration routes within the Pannonian and Western Pontic region. These findings will represent useful indicators for conservation objectives, since they highlight regions of high species richness *and* genetic diversity due to long-term *in-situ* persistence.

## **Does summer fire affect autumnal complexes of steppe arthropods? A case study in northeastern Ukraine**

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### **Session 3**

**Question:** Although fire and grazing are considered the key factors of steppe evolution, the impact of fire on small isolated steppe areas is still not fully understood. Our study aims at indicating the pioneer arthropod species at the burnt sites and monitoring changes in the arthropod communities. Such researches are badly needed, as uncontrolled arsons have become common occurrence in latest decades.

**Methods:** We conducted a four-year study in the steppe gullies of northeastern Ukraine. The arthropods were collected by pitfall trapping in the pre-fire (2013) and three post-fire years on the southeast-facing slope covered with the fescue-feathergrass vegetation. Vegetation height and density were measured as well.

**Results:** In the pre- and post-fire spider assemblages, the number of species did not change, the activity density slightly increased, while the dominance structure and species composition underwent major changes. One species appeared at the burnt plot, one disappeared, one reduced in number, and two increased and became main dominants.

Total activity density of insects dropped from 26.9 to 15.3 ind./trap after the fire, but recovered the next year. Ground beetles did not change significantly in diversity or abundance. Species and individual number of other beetles decreased dramatically and did not rebound to initial level. In the other taxa, the acrids' abundance increased, the cycads' decreased, the ants first reduced their number but then exceeded the initial abundance, and the true bugs were too rare to make conclusions.

We found no pyrophilous species or species attracted by fire and dominated the burnt plot.

The fire changed the trophic structure of the insect community. Phytophagous species, except acrids, suffered from fire, while zoophagous species benefited and started growing in numbers since the first year. Ants shown another dynamics with the first-year decrease. Saprophagous and necrophagous species were the most abundant in the pre-fire year.

**Conclusions:** Our studies proved that small-scale patchy fires affect the steppe arthropod community. Some groups of species benefited from burnings, the others suffered or stayed resilient. Each fire event should be thoroughly investigated in order to estimate its effect on local biota and develop appropriate management for maintaining steppe biodiversity.

## **The origin of dry grassland species in the context of conservation – postglacial migration routes and cryptic northern refugia**

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### **Session 4**

**Question:** Dry grasslands belong to the most diverse and endangered habitats in Central Europe. However, there is still insufficient information about the origin of the plant species related to these grasslands.

**Methods:** In our study we applied species distribution modeling and molecular markers (AFLPs, chloroplast microsatellites and trnL-trnF sequences) to identify glacial refugia and postglacial migration routes of the typical Central European dry grassland species *Hippocrepis comosa*, *Sanguisorba minor* and *Sedum album*.

**Results:** Our study revealed different patterns of (post)glacial survival and recolonization. *H. comosa* followed a latitudinal but also a longitudinal gradient during glaciation, restricting the species to southern refugia situated on the Peninsulas of Iberia, the Balkans and Italy. In *S. minor* we observed a distinct separation of eastern and western lineages. The analyses uncovered traditional southern refugia and point towards a broad fronted postglacial recolonization. Two distinct lineages were also detected for *S. album*. The migration routes ran north-eastward from glacial refugia in southern Iberia, northward from the Apennine Peninsula, and north- and westward from south-eastern parts of Central Europe. Almost more important is, however, that our study also provided evidence for the existence of cryptic northern refugia in western and central Europe in all three species.

**Conclusions:** Based upon our study it can be supposed that the present distribution of many dry grassland species in Central Europe has been affected by postglacial expansion from both classical southern and cryptic northern refugia. These refugia represent hotspots of genetic diversity, which should be included in conservation and management

plans to preserve both species and genetic diversity of dry grasslands across their distribution range in Europe.

## **Do human-engineering had evoked and guided the real ecological restoration of degraded grassland on Tibetan plateau?**

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### **Session 3**

**Question:** On Tibetan plateau, there are about  $5 \times 10^6$  ha of extremely degraded grassland (bare soil land), which led tremendous and huge carbon, water loss, and big economic loss without forage providing from the degraded land. From 2000, the central government, local government, local herders launched many ecological engineering to reclaim the degraded land for rebuilding ecological function, productive function and also livelihood. Especially for the 'bare soil land' ecological restoration, lot of money and facility had been invested to this issue. After 20 years, does the ecological restoration engineering had revised the degraded trend of 'bare soil land' and made real contributed the ecological function rebuilding and livelihood of local residents?

**Methods:** Based on the soil, vegetation field monitoring and benefit evaluation, including soil nutrition monitoring and comparison among field restoration engineering, vegetation and biodiversity evaluation with different ecological engineering years. Meanwhile, we did the livelihood evaluation in the herders levels, in which the ecological engineering had been done more than 10 years by grassland restoration project.

**Results:** We find some useful result, they are, (1) sown grassland technique had big effect for the bare soil land, that depend on the management level of local resident; (2) inter-systems' coupling had important for ecological function and productive function among different land types and status; (3) long-term research is key to show the restring effect on degraded grassland; (4) animal husbandry industry management is key to turn the grassland status for sustainable development.

**Conclusions:** In conclusion, we look forward more suitable suggestion for the ecological restoration engineering, and also more long-term monitoring study of the ecological engineering's effect on biodiversity and livelihood on Tibetan plateau.

## **50 years of changes in the grassland vegetation of a South German floodplain**

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### **Session 2**

**Question:** Cultivated grasslands in Central Europe decreased in area and habitat quality over the last decades, which is of growing concern for agriculture and nature conservation. Therefore, this study focused on changes in the vegetation of floodplain meadows within 50 years. Assessment took place at the landscape and habitat level.

**Methods:** The study was conducted in a 368 ha large floodplain section of the river Itz (Bavaria, Germany), a protected area with a high proportion of mesic to wet grasslands. At the landscape scale, vegetation maps from 50 and 24 years ago were compared with the current vegetation using GIS. Changes at the habitat level were evaluated by comparing vegetation surveys as well as environmental parameters from 1960/61 and 2012 with mean values of plant's fidelity from the mid-1980s.

**Results:** Quantitative analysis of classified land use types only showed a moderate decrease in grassland area. In contrast, the proportion of different plant communities changed strongly over the five decades. There was a trend to unification between and within plant communities as well as a shift from areas with wet to mesic communities. Furthermore, some grassland communities or variants totally disappeared.

Over the last 50 years, species richness in total and for individual plant communities decreased. Additionally, plant and bryophyte composition shifted greatly. Today, plants which are mowing tolerant and adapted to high contents of nutrients prevail.

**Conclusion:** The study revealed that although the quantity of grassland area was relatively constant since early the 1960s, the quality changed. The improved drainage system resulted in a water table drawdown and wet grassland communities as well as plants, adapted to moist conditions, declined. However, the unification in plant communities, the loss of biodiversity and the increase in plants adapted to high levels of nutrients indicates that the role of intensive land use has to be taken into account too.

## **Insect assemblages of urban grasslands**

Stephen Venn

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Session 1

**Question:** In Finland, 28% of threatened species, 30% of threatened butterfly species, 25% of threatened vascular plant species, 39% of regionally extinct (RE) species and 70% of threatened bee species are associated with cultural grassland habitats (Ref. 1). I sampled the vascular plant, carabid beetle and bee assemblages of grassland habitats in the metropolitan region of Helsinki under different levels of urbanization and management, during 2008-2012 to determine the factors affecting diversity of these taxa in an urban region.

**Methods:** Plants were sampled in three 1m<sup>2</sup> plots per site. Bees were sampled with pan-traps and carabid beetles with pitfalls.

**Results:** I recorded 252 plant species, and there was a correlation between number of species and site area, implying that site size and isolation restrict plant species richness. Sites with high nutrient levels had reduced plant species richness, however management by mowing reduced the level of nutrients, even in areas affected by traffic fumes (Ref. 2).

Seventy two bee species were recorded. Species that persisted in urbanized areas had greater flight ranges. Species with long colony cycles, small to medium-sized colonies and late emerging queens (e.g. *B. soroeensis*) were negatively affected by urbanization, whereas species with the opposite traits (e.g. *B. lapidarius*) persisted. Solitary bee species were sensitive to the amount of urban infrastructure adjacent to the grassland.

Carabid beetles (78 species) showed complex patterns of response to urbanization. Of those captured in sufficient numbers to test this in a GLMM, 10 were sensitive to urbanization, and two were more

abundant under high urbanization. The highest level of species diversity was recorded from dry and managed meadows. NMDS ordination showed that habitat moisture level strongly affected assemblage composition (Ref. 3).

**Conclusions:** The primary strategy for promoting biodiversity of semi-natural grasslands is to enhance their coverage and connectivity. It is necessary to ensure the implementation of appropriate management regimes, and to similarly manage adjacent areas of potential grassland habitat. Dry meadows and those with calcareous soils should be prioritized, as they have higher value for many taxa. Further study is necessary on the functions of these taxa and their trophic interactions.

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## **Destruction and natural reconstruction of reserved dry grassland: Fire vs. Plant interactions**

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### **Session 3**

**Question:** Fire is seem to have a catastrophic influence on the plant community but does it able to beat an effect of internal community factor of plant-plant interaction?

**Methods:** This is a part of big research of structure and plant-plant interactions of dry grassland community at National Reserve Belogorie (Ostrasievi Yari cluster), Belgorod region, Russia (data collected since 2005 to 2014). Located in forest-steppe chernozem zone Belogorie is a unique example of meadow steppe community most of which are destroyed by agricultural industry. We did both standard plant community plotting (with community-through sample plots on transections and random), but actually this method did not give us enough understanding on structure of this complex community. We concentrated on the problem of plant-plant interactions and, first of all, on the impact of bigger plants on the community structure. We chose 3 model species from 3 different life-forms: big grass *Verbascum lychnitis* L., suffrutex *Cytisus austriacus* L., shrub *Cytisus ruthenicus* Fisch.. More information about methods will be present in report.

**Results:** We have a proven effect of all 3 model species on the other species: on total projective coverage, species number per plotlet, individual projective coverage and occurrence of several species. All these parameters significantly decrease toward the center of this model plant's ecological field.

The year of the fire (2007) does not show integral difference in this tendency but reactions were expressed less for some species (especially for 2 species of *Salvia* that was very reactive in other years). The fire also

has influenced species ratio: species with ability to be pioneer were more abundant. For following years, starting from 2008 we did not detect any fire-caused features, the effect of model plants is stable with normal year-by-year fluctuation.

**Conclusions:** We may say that effects of plant-plant interactions in dry grassland community are even stronger than the impact of occasional spring fires. That is why when choosing the right conservation routine for this dry grassland we must pay great attention to the species balance.

## Posters

(Alphabetical order based on presenting author surname)

## **The heliophilous herbaceous edge communities of the *Trifolio medii-Geranietea sanguinei* class in Italian peninsula: a syntaxonomic synthesis**

Marina Allegrezza

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**Questions:** Knowledge of the natural vegetation dynamics in different territories is crucial for the timeliness and economy of actions to be adopted, particularly at their early stages. This is especially the case where the aim is biodiversity conservation of the semi-natural grasslands. The objective of this contribute is the syntaxonomic synthesis of the heliophilous herbaceous edge syntaxa of the *Asphodeletalia macrocarpi* Biondi & Allegrezza 2014 order (*Trifolio medii-Geranietea sanguinei* class) recognized in Italian peninsula and update by recent published study (Ref. 1).

**Methods:** 181 published relevés conducted in different areas of the central-southern Apennines were used to define the syntaxonomy, the vegetation dynamics, and the plant landscape.

**Results:** Three suborders of the order *Asphodeletalia macrocarpi* are recognized for central and southern Italy: *Asphodelenalia macrocarpi* (suborder *typus*), *Senecio scopolii-Brachypodienalia genuensis* and *Dorycnio herbacei-Brachypodienalia rupestris*.

**Conclusions:** The indications of the environmental features and preferential dynamic relationships of each syntaxa considered (at alliance level) contribute, in the present state of knowledge, as well as to define and clarify the ecological and landscape range of the order *Asphodeletalia macrocarpi*, to complete the main landscape units described for the central-southern Italy. At plant community level, the plant biondicators carry out by vegetation dynamics studies are fundamental to following the abandonment of the traditional anthropic practices on the grasslands, especially in the early stages that characterize it. Together with detailed ecological integrated studies on

permanent experimental areas, this is the basis for monitoring and for the planning of conservation and restoration actions of the grasslands.

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## **Plant biodiversity and ecosystem services patterns of in Mediterranean silvo-pastoral systems along a gradient of land use intensification**

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**Question:** How does land use intensity affect plant biodiversity and indicators of target ecosystem services in Mediterranean silvo-pastoral systems?

**Methods:** A gradient of land use intensification related with livestock farming was studied in a silvo-pastoral system located in northern Sardinia (Italy): low intensity, cork oak woodlands (WL); medium intensity, wooded grasslands 25-50% tree cover of cork oaks (WG) and high intensity, open grasslands (OG). WL are not cultivated since centuries; WG are grazed by sheep and periodically cultivated (5-10 years) to grow annual forage crops; OG are intensively managed, grazed and periodically cultivated (1-5 years) to grow annual forage crops. The experimental layout includes three sites and three replicates for each level of intensity. At each sampling unit we sampled vegetation and soil to characterize plant assemblage composition, assess biodiversity indices and ecosystem service indicators.

**Results:** The results showed great differences in plant species composition, plant biodiversity and ecosystem services along the intensification gradient and, within WL and WG, in the comparisons between shaded (below tree canopy) and unshaded areas (outside tree canopy). The highest value of average  $\alpha$  diversity (48) was observed in unshaded areas of WG, the highest value of  $\beta$  diversity was observed in WL understory (6.4) and the highest number of species unique to an assemblage was observed in the clearings of WL. Pastoral value was highest in OG (40.4); nectariferous value was highest in the WL understory (21.9); legume cover was highest in the clearings of WL (47.2%). Soil C stock was highest in WG and WL below the tree canopy (75 t ha<sup>-1</sup>)

**Conclusions:** The integrated assessment revealed that the most intensive land use reduced plant diversity but increased soil C stock and pastoral value.

The patchy diversity patterns observed in silvo-pastoral systems suggest that the maintenance of different land uses can guarantee the conservation of high levels of biodiversity and provide at the same time valuable ecosystem services. Our findings are the first available for Mediterranean silvo-pastoral systems and represent a basis for developing win-win management strategies able to maintain the economic activities while contributing to the conservation of biodiversity and ecosystem services.

## **Biodiversity of herbaceous vegetation in the transition area of Polistovsky Reserve, NW Russia**

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**Question:** Semi-natural grasslands are widespread in Europe and in the forest zone connected with human activity. In recent decades without agricultural use area of the grasslands decrease and they become overgrown with forest that leads to a strong decrease in biodiversity. The aim of the study is to reveal biodiversity of herbaceous vegetation (including semi-natural grasslands and semi-ruderal herblands connected with them spatially and successionaly) in the transition area of Polistovsky Reserve, Pskov Province, Russia. In our research we compare herbaceous vegetation remaining after several decades of abandonment and grasslands of currently managed (mowing and grazing) local sites in connection to Braun-Blanquet approach.

**Methods:** For this analysis, we choose 7 associations from 3 classes (*Molinio-Arrhenatheretea*, *Epilobietea angustifolii* and *Artemisietea vulgaris*) using our earlier classification based on 196 relevés. We compared floristic composition, species richness, coenotic and functional group shares (including participation of forbs, graminoids and woody species) between the syntaxa.

**Results:** The herbaceous vegetation of Polistovsky Reserve transition area contains 245 species, 145 genera and 45 families of vascular plants, including 5 red list species and 9 alien species. One of red list species *Dactylorhiza baltica* (*D. longifolia*) is listed in the Red Data Book of the Russian Federation, the others are regionally protected. Among the alien species *Festuca arundinacea* was the most frequent and had the highest frequency in communities of *Antoxantho odorati-Agrostietum tenuis*. This species is invasive for the region and is a threat to semi-natural grasslands. Studied associations differ in past and present management, floristic composition and ecological conditions as well as in coenotic and

functional group shares. Occurrence of these species groups is connected with the current state of the herbaceous communities.

**Conclusions:** The most valuable communities are *Filipendulo ulmariae-Geranium palustri*, *Polygono bistortae-Cirsium heterophyllum*, *Antoxantho odorati-Agrostietum tenuis*. These communities have the highest species richness and are habitats of red list species. However, in conditions of abandonment these communities are under threat and constant monitoring and development of protection system is necessary.

The reported study was funded by RFBR according to the research project № 18-34-00786.

## **Suitability of agricultural management of meadows in the SCI Krkonoše, the Czech Republic**

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The meadows in the Krkonoše Mts (SCI Krkonoše, the Krkonoše Mts National Park and its buffer zone) include following Natura 2000 habitats: 6230\*: Species-rich *Nardus* grasslands, on siliceous substrates in mountane areas (and submountane areas, in Continental Europe), 6510 - Lowland hay meadows and 6520 - Mountain hay meadows). Specific species composition is caused by unique combination of plants from alpine zones and lowlands influenced by history of mountains colonization and farming. Nowadays extensive agricultural management play the main role for favourable conservation status of the meadows. Grassland habitats are often exposed to inappropriate management, leading to deterioration of its quality. We aimed to identify localities with the most valuable meadows, which are at the same time threatened by inappropriate farming.

We selected more than 5.5 thousand ha meadows of different quality and mapped their current management and its main parameters (type of management care – period and number mowing, pasture (type of grazing animal), mulching etc.) in the year 2017. Based on the data, the overall suitability of management was determined, and the ArcMap program used to generate a layer of top quality grassland biotopes with improper or no management.

A positive finding is presence of management measures on more than 85% of the total area of the meadows. On the other hand, less than 1,200 hectares of the meadows were negatively affected by inappropriate management or abandonment; in the presence of management, mulching was the most common offence. The obtained data will serve mainly to set up a system of care for the most endangered meadows. At

the same time they will be used as a material for evaluating the effectiveness of CAP and other subsidies for maintenance of meadows.

**Is typicality of habitat 6210 pastures correlated with their conservation value? a study case in the Abruzzo region (central Italy).**

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**Question:** About 150 phytosociological relevés were recently attributed to the habitat 6210 in three protected areas of the Abruzzo Region (Central Italy) during works aimed to draft the management plans of several Natura 2000 sites. The phytosociological attribution of the communities had already highlighted a good phytocoenotic diversity in terms of associations, subassociations and variants. Now we try to answer to the following questions: how much the identified vegetation types are typical of the habitat? May it depend on what we consider as typical? Does a positive correlation exist between tipicality and “conservation value”?

**Methods:** The single phytosociological tables of the identified vegetation types have been analyzed in order to measure a value of tipicality. Leaving out features related to the structure, it was made counting the species listed in the European and in the Italian Manuals of EC Habitats Interpretation, both in terms of presence and frequencies. The obtained values have been compared with the presence and the frequencies of endemic and/or rare plant species, considering that as the “conservation value” of the vegetation types.

**Results and Conclusions:** The analysis confirms a good tipicality for most of the vegetation types, especially following the Italian Manual of Interpretation. However, a linear positive correlation between tipicality and “conservation value” is hard to be found.

## **A baseline for lichen monitoring on the GLORIA summits of the Majella National Park**

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**Question:** The network of GLORIA summits is among the main tools available for monitoring and predicting plant responses to climate warming. Its strengths are the wide distribution of the sites, encompassing the mountain systems of the world, and the strong standardization of the sampling protocol that allows comparisons across sites and across time-slices. This protocol was mainly conceived for vascular plants, according with the main focus of the research project. However, the protocol also includes an optional section devoted to cryptogams, including bryophytes and lichens. This work aims at implementing the monitoring activity on the GLORIA summits included in the Majella National Park providing a baseline dataset on lichen communities.

**Methods:** Two out of the three summits were surveyed in 2017, while the third one will be surveyed in 2018, according to the GLORIA protocol. In particular, four permanent plots (1mx1m) were investigated, for each exposure on the summit of Femmina Morta (IT\_CAM\_FEM) at 2405 m a.s.l. and on the summit of Mount Mammoccio (IT\_CAM\_MAM) at 2727 m a.s.l.

**Results:** One summit, IT\_CAM\_FEM, hosts terricolous lichen communities, while the other one, IT\_CAM\_MAM, hosts only saxicolous lichen communities mainly composed of endolithic species. Overall, 37 species were found, including 14 terricolous and 23 saxicolous lichens. *Toninia subnitida*, a species related to more or less calcareous substrata

in upland areas and already known from the Alps and the mountains of Basilicata and Sicily was here found for the first time in Abruzzo.

**Conclusions:** As soon as the survey will be completed with the third summit, M. Macellaro (IT\_CAM\_MAC) at 2635m a.s.l. the baseline dataset will be available for monitoring lichen temporal patterns and evaluating the effects of global warming on these organisms in summit areas.

## **Terricolous lichen communities in *Thero-Airion* dry grasslands of the Po Plain (N Italy)**

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**Question:** Terricolous lichen vegetation has been poorly studied in Italy so far, particularly in the Po Plain. In the western Po Plain (Piedmont and Lombardy), pioneer acidic *Thero-Airion* dry grasslands host plentiful terricolous lichens. Is there a good diversity in terricolous lichen communities occurring in this habitat? Should these communities be taken in account for management and conservation?

**Methods:** Overall, 289 phytosociological relevés were carried out with the Braun-Blanquet approach within a standard plot of 30 x 30 cm in lichen-rich stands of these grasslands placed in 19 localities. These relevés were manually sorted and the species composition was analyzed through Principal Component Analysis (PCA) and non-parametric MANOVA. Ecological indices were computed for each relevé and analyzed through Kruskal-Wallis test to assess ecological differences between the communities.

**Results:** Nine lichen communities were recognized: one community dominated by *Cladonia pulvinata* referred to the *Pycnothelio-Cladonietum cervicornis*; three communities referred to the *Cladonietum foliaceae*, dominated respectively by *Cladonia foliaceae*, *Cladonia furcata* and *Cladonia rangiformis*; three communities referred to the *Cladonietum rei*, dominated respectively by *Cladonia rei*, *Cladonia polycarpoides* and *Cladonia coccifera*; two communities dominated respectively by *Cladonia peziziformis* and *Cladonia cariosa* referred to an undescribed association temporarily attributed to the *Cladonion rei*. All these communities differ significantly for the main ecological indices – soil pH, light, aridity, eutrophication, poleotolerance. The *Pycnothelio-Cladonietum cervicornis*, the *Cladonia peziziformis-Cladonia cariosa* community and the *Cladonia foliaceae*-dominated *Cladonietum foliaceae* are the most pioneer communities, while the *Cladonia rangiformis*-

dominated *Cladonietum foliaceae* and the *Cladonia rei*-dominated *Cladonietum rei* are the most evolved ones, respectively in undisturbed and disturbed sites. The two latter are also the most widespread communities.

**Conclusions:** Our results show how terricolous lichen communities represent an important component of biodiversity in *Thero-Airion* grasslands, due to their diversification in different *syntaxa* and, in some cases, to their role as a microhabitat for species of conservation concern. Thus, their knowledge should be seen as a key component in the choice of management and conservation strategies of *Thero-Airion* grasslands.

## **Early successional grassland community dynamics in a restored landfill (southeastern Italy)**

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**Question:** The recovery of grasslands has become one of the cornerstones of biodiversity conservation policy in Europe. However, only few studies have taken into account spontaneous regeneration patterns and restoration experiments in dry grasslands of southern Italy, where several plant communities of conservation concern occur. This study aimed at presenting insights into the early successional vegetation patterns of restored herbaceous communities. The restored site is on a landfill in the Alta Murgia protected area (southeastern Italy).

**Methods:** Cover values of vascular plant species were collected in the first and second year after landfill restoration, considering three different types of restored sites (i.e. the flat top surface, the margin, and the reinforced soil wall) as well as the surrounding semi-natural grassland area. Relative Response Indices (RRI) were calculated for assessing the difference between restored sites and reference grassland in terms of the cover of main functional groups, i.e. life forms and target grassland specialists and weed species.

**Results:** Among the 154 plant species occurring in the reference grassland area, 98 (63%) and 107 (69%) were found in the restored area respectively in the first and the second year after restoration. In particular, the large majority of them were found at the margin of the area, where the restored site is directly adjoining to the grassland communities. During the first two years, a considerable increase in annual grass cover (+13%) and a rapid decrease in large biennial forb cover (-12%) reveal a general shift towards annual semi-natural grassland communities. Moreover, an increasing similarity (RRI) to the

reference grassland was found in terms of characteristic species of semi-natural and ruderal communities.

**Conclusions:** This preliminary study represents a starting point for monitoring vegetation dynamics across time, which would provide a better understanding of successional processes in the poorly investigated study site. These findings, underlining the predominant role of natural colonization by species from adjacent habitat patches, may also be of interest when assessing the feasibility of expensive and time-consuming restoration methods.

## **Genetic conservation areas – A new approach to protect both species and genetic diversity of litter meadows**

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<sup>1</sup> T. A. Lehmair and E. Pagel contributed equally to this work

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**Questions:** Litter meadows are species-rich and diverse ecosystems. Established by traditional land use, these meadows were designed to produce litter for animal housing. In the recent decades, these cultural relicts drastically declined due to the replacement of litter by slatted floors. A comprehensive conservation approach should include not only species diversity, but also the genetic variation of the species within these grasslands. Considering the impact of land use continuity, historically old grasslands may contain populations with a higher level of genetic diversity and may also be differentiated from historically younger grasslands.

Thus, the first aim of our study was to test, whether populations in historically old grasslands differ genetically from populations in historically young grasslands. The second goal was to identify those populations with a high genetic diversity and number of rare alleles, which can then be included in a set of genetic conservation areas.

**Methods:** We took leaf samples from 20 litter meadows across the Baden-Wuerttembergian Allgaeu in southern Germany. Using Amplified Fragment Length Polymorphism analysis (AFLP), we analyzed populations of *Angelica sylvestris* L. and *Succisa pratensis* MOENCH, including equal amounts of historically old and young populations.

**Results:** Genetic diversity was comparable to other common plant species, with *A. sylvestris* exhibiting slightly higher values. We found neither genetic differentiation, nor isolation by distance among the studied populations. Additionally, none of the plant species showed an effect of land use history on their genetic diversity.

**Conclusions:** Populations of both species seemed or seem to be well connected by gene flow. Based on these results, we will be able to construct a minimal set of populations representing the genetic diversity of the investigated species accurately. These litter meadows will then be a part of a larger conservation framework including species as well as genetic diversity. These so called “genetic conservation areas” will provide seed material for in situ storage in gene banks, as well as other conservation and restoration measures.

## **Steppe gullies in the Inhulets River basin: conservation value based on plant and spider diversity**

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**Question:** Despite the 140-year history of the ironstone mine workings in the middle flow of the Inhulets basin, natural ecosystems of the intact areas has preserved their identity. The unploughed gullies serve as a refuge for virgin steppes; three habitats presented there are listed in the Resolution 4 of the Bern Convention (E1.11 Euro-Siberian rock debris swards; E1.2 Perennial calcareous grassland and basic steppes; F3.247 Ponto-Sarmatic deciduous shrubs). Local multi-taxon investigations are badly needed for the conservation value assessment and including prospective areas in the European Emerald Network.

**Methods:** Vegetation of the area in question has been studied for 30 years, while arachnological researches were launched only in 2017. We investigated five localities in the Kryvyi Rih vicinity.

**Results:** Typical herbaceous vegetation of the study area is represented by the class Festuco-Brometea (orders Festucetalia valesiaca and Galatello villosae-Stipetalia lessingiana); rare communities of the rock outcrops belong to the unit Poo bulbosae-Stipion graniticola. Twenty-two plant species are listed in the Red Data Book of Ukraine; of these, *Eremogone cephalotes* is included in the European Red List. *Stipa capillata*, *S. lessingiana*, and *S. pulcherrima* are widely distributed in the region, while the other protected species have a limited number of habitats. *Allium lineare*, *Sedum borissovae* and *Gymnospermium odessanum* occur only in one locality on the amphibolite and slate rocks.

Among 95 spider species recorded in steppe habitats, 11 are rare in Ukraine; two species have western- or easternmost boundaries of their geographic ranges in the study area. The species-rich spider communities of Zelena and Chervona gullies (65-67 species) can serve as

indicators of the well-preserved steppe habitats in the south of Ukraine. Uncontrolled grazing and fires in the Khrystoporova gully result in a decrease of spider diversity (36 species) and an increase in the number of generalist species.

**Conclusions:** Natural habitats of the Inhulets basin have a high potential for inclusion in the Emerald Network of Ukraine.

## Diagnostic species and plant traits of *Nardus* grasslands in the Iberian Peninsula

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**Question.** Which are the diagnostic species of the *Nardus* grasslands in the Iberian Peninsula? Can the diagnostic species be related with some plant traits?

**Methods.** We performed a k-means classification in a dataset of vegetation plots corresponding to semi-natural grasslands and perennial anthropogenic vegetation. We obtained a classification of *Nardus* grasslands into four groups at an alliance-level and diagnostic species were identified by calculating the fidelity measured by the phi ( $\Phi$ ) coefficient. An ordination analysis was applied for exploring the relationships between the parameters, richness and relative cover of diagnostic species, with the trait values in each of the four *Nardus* grasslands groups. Traits used in the analysis were morphological, chorological and ecological (Ellemer Indicator Values) traits, and plant strategies (Grime's CSR Model).

**Results.** *Nardus* grasslands were classified into four groups: (1) Cantabrian-Atlantic (*Violion caninae*); (2) Iberian Eurosiberian orotemperate (Orocantabrian and Pyrenean) (*Carici macrostylido-Nardion strictae*); (3) Iberian Mediterranean orotemperate (submediterranean) and oromediterranean (Oroiberian, Carpetan-Leonese and Nevadensean) (partially *Campanulo-herminii-Nardion strictae*, *Plantaginion thalackeri*); (4) Iberian Mediterranean supratemperate (submediterranean) (partially *Campanulo-Nardion*

*strictae*). Results showed some coincidences among all groups in the type of vegetative propagation and plant strategies correlated with the relative cover of diagnostic species. Cantabrian-Atlantic grasslands showed different relationships in the chorological traits with respect to the rest of groups. Traits that were negatively correlated with the relative cover of diagnostic species can be interpreted as indicators of degradation processes.

**Conclusions.** *Nardus* grasslands are semi-natural grasslands widely represented in the temperate Eurosiberian territories and in mountain areas in the Iberian Peninsula. The identification of their characteristic species is needed to evaluate and monitoring the conservation status of these habitat types. However, it is when exploring the whole composition of the community, we can interpret changes in the community structure as a response to degradation processes. As an alternative or complementary tool to the species-level analysis of the compositional change into a degradation process, we propose a partition of the component species into functional types or guilds that can be related to the identity of the habitat type.

## **Classification of dry grassland vegetation in the east of Russian plain by methods of neural networks**

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**Question:** To determine the priorities for the plant species conservation in the forest-steppe landscapes at the southeast of the European part of the Russian Federation.

**Methods:** 1062 plots of meadows and steppes were used from the Vegetation Database of Tatarstan (GIVD Database ID: EU-RU-011). Applying the calculation of the Euclidean distance and neural network of 10x10 neurons, the ordination of the 100 selected classes was carried out. The classes allocated by the neural network form gradient series for soil moistening and anthropogenic impact. Using the computer expert system for identification of EUNIS habitat types and computer expert system for identification Braun-Blanquet syntaxes, the correspondence of each plot from all classes of neural network was performed.

**Results:** It has been established that in all classes there are plots including ruderal species, which indicate a widespread impact of vegetation due to grazing, recreation, erosion processes and fires. In 83 neural network classes of 100 the occurrence probability of meadow species is much higher than forest-meadow and meadow-steppe species. 17 classes are characterized by the predominance of steppe xerophytic plant species. The correspondence of plots to 24 habitat types of EUNIS is revealed. Among them the most common are E12a, E12b, E21, E22, F31f, X06. A large number of plots with the participation of forest-steppe plant species referred to the habitat Y-For, suggests that there are specific habitats in the east of the Russian plain. The presence of plots not attributed to any of the EUNIS habitats also indicates the vegetation specificity. There is high probability of steppe species located on the western boundary of their geographical range. The analysis of the correspondence of the neural network classes to the Braun-Blanquet syntaxons shows that the classes *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947, *Brachypodio pinnati-Betuletea pendulae* Ermakov et al. 1991,

Molinio-Arrhenatheretea Tx. 1937, Artemisietea vulgaris Lohmeyer et al. in Tx. ex von Rochow 1951 are the most characteristic for the investigated vegetation.

**Conclusions:** In the investigated area there are specific habitats and vegetation syntaxons. Eastern species of the Siberian and Asian ranges are rare and endangered and need conservation (*Phlox sibirica* L.).

## Diversity of humid dunes slacks (2190) in Latvia

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**Question:** Dune slacks are linear depressions close to sea level in coastal dune systems, which lie between the ridges of coastal dune systems. Dune slacks occur within primary, secondary and relative stable dunes on post Baltic Ice Lake transition area in Latvia, including post Littorina Sea impact area.

All dune slacks in Latvia are protected on the State and Europe Union level as very rare habitat. At present all dune slack habitats in Latvia cover 1400 ha or 0.02% of the country.

Clarify subtypes and successional pathways of older successional stage humid dune slack vegetation in the NW oc country – the main distribution area of the core habitat.

**Method:** The research has been made in Slitere National Park and along the western part of the Riga Gulf, in the coastal zone of the Baltic Sea, in Latvia. The study area – wet dune slacks are part of the unique habitat and landscape complex of wet dune slacks and biologically old wooded dunes.

To study structure and functions of the habitat, and plant communities in dune slacks of inter - dune complexes vegetation was assessed in 18 transects, and 48 vegetation sample plots in all were established. Structure and functions of the habitat was registered in special questionnaire.

**Results:** This succession on wet sand, however, is very different to that on the dry dunes. A range of wetland plants are important and early vegetation can be extremely species-rich with plants, for example: *Equisetum variegatum*, *Sagina nodosa*, *Juncus buffonius*, *Centaureum littorale*, *Ranunculus sceleratus*, as well as with number of bryophytes. While in dunes slacks with mire vegetation, one can determine three

types of peatland – bog, fen and transition mire, where key species are *Carex sp.* and *Sphagnum sp.*

**Conclusions:** Structure of humid dune slacks in Latvia is not homogenous. It varies from extremely dry in coastal areas to dry or wet towards inland, as well as, composition of vegetation varies. Dune slacks in Latvia mainly developed in process of primary succession and following development towards forest of bog with some stages of grasslands.

## **The impact of historical land use on the creation of sandy grasslands**

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**Question:** Sandy grasslands are highly endangered habitats in Germany, especially in the southeast. Reasons are, declining disturbance by missing management and replacement by agriculture. To protect these habitats from extinction, conservation organizations are trying to create new sites. Therefore, they are transforming arable fields or clearing forests, with differing success. To understand the variation between the sites, we wanted to know if there are differences in vegetation composition caused by the original land use.

**Methods:** By using an overlay-analysis of historical cadastral maps, we determined the origin and age of recent sandy grasslands to survey the vegetation and soil chemistry. As study area, we chose the conservation area Hainberg (Nürnberg, Germany), which is protected and managed by grazing over the last 23 years. Due to this, we expect that management is not the determining variable for vegetation structure. Therefore, appearing differences in species composition should be described by origin or time.

**Results:** Through the survey of the vegetation and the evaluation of the soil parameters, we found clear differences between sites. These anomalies in species and chemistry composition show a strong correlation with the historical land use.

**Conclusion:** Based on our research, we can integrate the land use history in the selection of promising sites for the creation of new sandy grasslands.

## **The fate of Slovenian Central European dry grasslands in a changing landscape**

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**Question:** What was the extent of the decline in orchids-rich meadows in Haloze region (the North East of Slovenia) between 2006 and 2016?

**Methods:** In our study we quantified changes in dry grassland area in Haloze region (tertiary hilly area app. 172.5 km<sup>2</sup>) between 2006 and 2016, by comparing data of habitat types mapping using GIS. The fine-resolution field HT mapping (horizontal resolution of 2 m) followed the PHYSIS typology of habitats based on the Palearctic classification, which was adapted and modified for use in Slovenia. For each polygon data about the conservation status (favourable/non-favourable), land-use (grazing, mowing, and abandonment) and intensity of land-use (extensive, intensive) were also collected.

**Results:** Main outcomes of our study are: (i) during the last decade, cover of dry grasslands decreased by over 25% in the study area; (ii) 50% of still existing dry grasslands are in unfavourable conservation status mainly due to abandonment.

**Conclusions:** Although Slovenia is a country with the largest share of territory included in the network Natura 2000, the current measures that have been put in place to preserve species-rich semi-natural grassland habitats in Slovenia are insufficient and inadequate. Greater efforts should be made to design appropriate conservation strategies to counteract the drivers of dry grassland habitat loss.

## **Climate, soil, and vegetation are interacted to influence plant and soil $\delta^{15}\text{N}$ in the Tibetan grasslands**

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**Question:** Plant and soil  $^{15}\text{N}$  ( $\delta^{15}\text{N}_{\text{plant}}$  and  $\delta^{15}\text{N}_{\text{soil}}$ ) can indicate ecosystem nitrogen (N) cycling. However, little is known how biotic and abiotic variables influence them, directly and independently, or indirectly and interacted in a networking way.

**Methods:** Both  $\delta^{15}\text{N}_{\text{plant}}$  and  $\delta^{15}\text{N}_{\text{soil}}$  were investigated at nine sites, three replicates per grassland type, along an alpine grassland transect across deserts, steppes, and meadows in North Tibet. Meanwhile, climate conditions were collected, and soil nutrients and vegetation properties were measured at each sites. Differences among grassland types were examined by t-tests for climatic variables and ANOVA for others. Spatial patterns of  $\delta^{15}\text{N}_{\text{plant}}$  and  $\delta^{15}\text{N}_{\text{soil}}$  along regional environmental gradients were examined by bivariate linear regressions, while the relative

importance of each term was decomposed by multivariate linear models with ANOVA. Structural equation models were performed to discover the direct and indirect influential pathways onto  $\delta^{15}\text{N}_{\text{plant}}$  and  $\delta^{15}\text{N}_{\text{soil}}$ .

**Results** Both  $\delta^{15}\text{N}_{\text{plant}}$  and  $\delta^{15}\text{N}_{\text{soil}}$  decreased with increases in growing season precipitation (GSP), species richness, community productivity, and soil total nitrogen (STN), but increased with increases in growing season temperature (GST) and soil total phosphorus (STP). GSP explained most the variance in  $\delta^{15}\text{N}_{\text{plant}}$  and  $\delta^{15}\text{N}_{\text{soil}}$  by bivariate and multivariate linear models. The direct influence of STP on  $\delta^{15}\text{N}_{\text{soil}}$  was stronger than that on  $\delta^{15}\text{N}_{\text{plant}}$  between two structural equation models, conversely, the GSP influences.

**Conclusions** Precipitation is the most critical factor in shaping the spatial patterns of  $\delta^{15}\text{N}_{\text{plant}}$  and  $\delta^{15}\text{N}_{\text{soil}}$ , with indirectly through controlling species diversification and assemblage, and plant growth and interspecific competition. The trends of  $\delta^{15}\text{N}_{\text{plant}}$  with STP and STN were opposite, indicating a shift of plant growth limitation by P in meadows to N in deserts. However, soil P availability may be more critical in N mineralization than in plant's N-niche separation. Overall, our results facilitate to fully understand the mechanisms underlying ecosystem multifunctionality in species coexistence, N-cycling, and productivity.



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