

14th Eurasian Grassland Conference

Semi-natural Grasslands Across Borders

BOOK OF ABSTRACTS

Edited by Solvita Rūsiņa

4-11 July 2017
Riga (Latvia) and Western Lithuania

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**UNIVERSITY OF LATVIA
FACULTY OF GEOGRAPHY AND EARTH SCIENCES**

**14th Eurasian Grassland Conference
Semi-natural Grasslands
Across Borders**

BOOK OF ABSTRACTS

**4–11 July 2017
Riga (Latvia) and Western Lithuania**

Scientific Committee

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Domas Uogintas, Nature Research Centre, Lithuania

Conference venue

Faculty of Geography and Earth Sciences, Academic Centre for Natural Sciences,
University of Latvia, Latvia

Editor Solvita Rūsiņa

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The respective authors are solely responsible for the contents of
their contributions in this book.

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PREFACE

This volume includes the abstracts of the 14th Eurasian Grassland Conference (EGC), held in Latvia in 2017. This year the conference focused on the topic "Semi-natural grasslands across borders".

The EGC is the main annual event of the European Dry Grassland Group (EDGG, www.edgg.org). EDGG is a Working Group of International Association for Vegetation Science (IAVS, www.iavs.org), which was established in August 2008. Its basic aims are to compile and to distribute information on research and conservation of natural and semi-natural grasslands beyond national borders, thus encouraging active cooperation among scientists and practitioners.

During the conference, recent research results were presented by linking them to practical management and policy which contribute to sustainability of natural and semi-natural grasslands. The emphasis was put on cases when grassland ecosystems are dispersed across human made and natural geographical borders. These topics were highlighted by two keynote speakers who kindly agreed to share their knowledge with the audience of the conference.

We, the organizers, wish to thank everyone who helped us with suggestions and advice, and all the participants who were willing to share their ideas and to attend the conference. We gratefully acknowledge the contributions of several sponsors who made organizing of this conference possible. Finally, we thank the University of Latvia for hosting this event.

On behalf of the Organizing Committee
Solvita Rūsiņa

SCHEDULE AT A GLANCE

Tuesday 4 July 2017

Pre-conference excursion (Daugavpils, Eastern Latvia)

Wednesday 5 July 2017

Pre-conference excursion (Daugavpils, Eastern Latvia)

9:00-18.00 Technical workshops (1 Jelgavas Street, University of Latvia)

18.00-19.00 Registration and possibility to install posters (1 Jelgavas Street, University of Latvia)

Thursday 6 July 2017

8.00-9.30 Registration

9.30-9.45 Opening Ceremony

9.45-11.00 Keynote Lecture

11.00-11.15 Coffee break

11.15-12.55 Paper Session I

12.55-14.00 Lunch

14.00-16.00 Paper Session II

16.00-16.20 Coffee break

16.20-17.20 Poster Session I

17.30-19.00 Guided tour – Old Riga

Friday 7 July 2017

8.00-22.00 Mid-conference excursion (Western Latvia), Grassland party.
Departure at 8.00 am from the Academic Center for Natural Sciences, 1 Jelgavas Str.

Saturday 8 July 2017

8.30-9.00 Registration

9.00-10.15 Keynote Lecture

10.15-11.15 Paper Session III

11.15-11.35 Coffee break

11.35-12.55 Paper Session III (continued)

12.55-14.00 Lunch

14.00-15.40 Paper Session IV

15.40-16.00 Coffee break

16.00-17.00 Poster Session II

17.00-18.30 EDGG General Assembly, Closing Ceremony

Sunday to Tuesday 9-11 July 2017

Post-conference excursion (Western Lithuania). Departure on 9 July at 8.00 am from Academic Center for Natural Sciences, 1 Jelgavas Str. Return to Riga on 11 July at ca. 12.30 am (Academic Center for Natural Sciences, 1 Jelgavas Str.).

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CONFERENCE PROGRAMME

4-5 JULY, TUESDAY-WEDNESDAY

PRE-CONFERENCE EXCURSION

Meeting place - Academic Center for Natural Sciences, 1 Jelgavas Str.

4 July, 7.30–8.00 Registration for the excursion

8.00 Departure from Riga

5 July, ca. 21.00 Arrival to Riga, 1 Jelgavas Str.

5 JULY, WEDNESDAY

TECHNICAL WORKSHOPS

Academic Center for Natural Sciences, 1 Jelgavas Str.

9.00–13.00 Introduction to R for statistical analysis led by
Didzis Elferts
Room No. 209

14.00–18.00 Introduction to ggplot2 graphical system
(program R) led by Didzis Elferts
Room No. 209

18.00–19.00 Registration, mounting of posters
Entrance-hall

6 JULY, THURSDAY

TALK AND POSTER SESSIONS

Academic Center for Natural Sciences, 1 Jelgavas Str.

Entrance-hall, Room No. 106 Magnum

8.00–9.30 Registration, mounting of posters

9.30–9.45 Opening ceremony
Welcome address of the representatives of the
University of Latvia and Latvian Botanical Society;
Welcome address of the chairs of the Eurasian Dry
Grassland Group

9.45–11.00

KEYNOTE LECTURE

Semi-natural grasslands in Estonia: importance, ecology and conservation efforts

Aveliina Helm, University of Tartu, Estonia

11.00 – 11.15

Coffee break

SESSION I CHAIR: PETER TÖRÖK

11.15–11.35

Changing of assembly rules during secondary succession: are there trends?

Anikó Csecserits, Melinda Halassy, Barbara Lhotsky, Tamás Rédei, Zoltán Botta-Dukát

11.35–11.55

(YIP*) Do rare herbs have large seeds? The seed size - distribution range trade-off hypothesis

Judit Sonkoly, Balázs Deák, Orsolya Valkó, Attila Molnár V., Béla Tóthmérész, Péter Török

11.55–12.15

(YIP) Reaching the (north)western distribution limit in Central Europe – a phylogeographic transect study on the genetic constitution and fitness of steppe grassland species

Kristina Plenk, Katharina Bardy, Maria Höhn, Mike Thiv, Matthias Kropf

12.15–12.35

(YIP) Origin of steppe flora and fauna in inner-Alpine dry valleys

Philipp Kirschner, Eliska Zaveska, Wolfgang Arthofer, Bozo Frajman, Alexander Gamisch, Birgit C. Schlick-Steiner, Peter Schönschwetter, Florian M. Steiner

12.35–12.55

Mountain grasslands in central Greece

Pinelopi Delipetrou, Maria Sarika, George Michopoulos, Georgios Karetsos

12.55–14.00

Lunch

SESSION II CHAIR: MONIKA JANIŠOVA

14.00–14.20

Habitat selection of a steppic bird at multiple scales

Didem Ambarli

-
- 14.20–14.40** **Bee assemblages of meadow habitats in the Helsinki region of southern Finland are affected by adjacent landscape structure**
Stephen Venn
-
- 14.40–15.00** **(YIP) Grasshopper and ground beetle fauna in calcareous grasslands of Abava River valley**
Rūta Rozenfelde, Laura Reimane, Voldemārs Spuņģis
-
- 15.00–15.20** **Long-term changes in species richness of flies (Diptera, Brachycera) in grassland communities of Engure Nature Park, Latvia**
Viesturs Melecis, Aina Karpa, Solvita Rūsiņa, Ģertrūde Gavrilova, Kristaps Vilks
-
- 15.20–15.40** **(YIP) Impact of grazing on feed values and mineral concentrations in mountain grasslands of Qilian Shan, NW China**
Alina Baranova, Shunli Wang, Udo Schickhoff
-
- 15.40–16.00** **Grazing abandonment results in decline of zoochoric species – an evidence from dark diversity analysis in Central European grasslands**
Martin Magnes, Monika Janišová, Silvia Bittnerová, Jozef Suja, Karol Ujházy, Eva Uhliarová, Philipp Sengl
-
- 16.00–16.20** **Coffee break**

POSTER SESSION I CHAIR: PĒTERIS LAKOVSKIS

- 16.20–17.30** **(YIP) Anna Kovtoniuk** Spontaneous grassland vegetation of the garden and park landscapes of the Middle Bug region (Ukraine)
Valerijus Rašomavičius, Domas Uogintas Diversity, distribution and future prospects of EU natural and semi-natural grassland formations in Lithuania
Lauma Gustiņa, Solvita Rūsiņa History of semi-natural grassland management in Latvia
Denys Vynokurov The boundary between steppe and desert zones in the Republic of Kalmykia (syntaxonomical delimitation)
Lukas Petrulaitis, Zigmantas Gudžinskas Symphyotrichum species possess potential threat to meadow habitats
-

16.20–17.30

Kateryna Norenko Invasive grassland species
Elaeagnus angustifolia on the northern and western
 boundaries in Ukraine

(YIP) Valentina Borodulina, Oxana Cherednichenko

Phytodiversity and ecology of herbaceous
 vegetation in the buffer zone of Polistovsky Reserve
 (NW Russia)

(YIP) Yuliya Rozenblit, Yakiv Didukh Sigma-syntaxa
 of the dry grassland vegetation in the Dnister River
 Canyon

Vitaliy Kolomiychuk Coenoflora of *Trachomitum*
venetum (L.) Woodson subsp. *sarmatiense*
 (Woodson) Avetisjan in the Sea of Azov coastal zone

17.30–19.00

Guided tour to Old Riga
 (meeting in entrance-hall)

7 JULY, FRIDAY

MID-CONFERENCE EXCURSION

Meeting place - Academic Center for Natural Sciences, 1 Jelgavas Str.

7.30–8.00

Registration for the excursion

8.00

Departure

8.00–18.00

Excursion

18.00–20.00

Grassland Party

ca. 22.00

Return to Riga (1 Jelgavas Street)

8 JULY, SATURDAY

TALK AND POSTER SESSIONS

*Academic Center for Natural Sciences, 1 Jelgavas Str.,
 Room No. 106 Magnum*

8.30–9.00

Registration

9.00–10.15

KEYNOTE LECTURE

**In Hands of Farmers and Society: Fate of the
 Semi-Natural Grasslands in the Boreal Region**

Irina Herzon, University of Helsinki, Finland

SESSION III CHAIR: IVO VINOGRADOVS

10.15–10.35 **Changes of traditional management decreased functional diversity of poet's daffodil hay meadows: implications for conservation and restoration**

Michele Carbognani, Marcello Tomaselli, Cesare Lasen

10.35–10.55 **(YIP) Influence of different management treatments on functional diversity in the semi-natural grassland communities**

Silvia Bittnerová, Dobromil Galváněk, Monika Janišová, Eva Uhliarová, Karol Ujházy, Mariana Ujházyová, Ingrid Turisová

10.55–11.15 **Graduated intensity of Grassland Management in Lower Austria – A Case Study of Puchberg am Schneeberg**

Harald Roetzer, Barbara Steurer, Gerald Biedermann

11.15–11.35 **Coffee break**

11.35–11.55 **From goals to action! - an action plan for management of semi-natural grasslands in Finnish conservation areas completed**

Carina Järvinen, Katja Raatikainen

11.55–12.15 **ALL-EMA - Monitoring farmland species in grassland and other habitats of the Swiss agricultural landscapes**

Gabriela Hofer

12.15–12.35 **GrassPlot database - a collaborative initiative within the framework of the Eurasian Dry Grassland Group (EDGG)**

Monika Janišová, Jürgen Dengler, Idoia Biurrun, Timo Conradi, Iwona Dembicz, Riccardo Guarino, Alireza Naqinezhad, Viktoria Wagner, & the GrassPlot Consortium

12.35–12.55 **Biodiversity of the chalk grasslands of Eastern Ukraine and the problems of its conservation**

Nina Polchaninova, Galina Savchenko, Vladimir Ronkin, Vladimir Kletenkin, Larisa Borovyk, Sergei Limanskij

12.55–14.00 **Lunch**

SESSION IV CHAIR: DIDEM AMBARLI

- 14.00–14.20** **'Our Molinia meadows were walking away', Hydrological research used in Flemish grassland restoration**
Bram Cannaerts
- 14.20–14.40** **Ecological theories provide strong support to grassland recovery - New frontiers in restoration**
Peter Török, Aveliina Helm
- 14.40–15.00** **Grassland habitats of the European importance in Ukraine: identification and inventory**
Anna Kuzemko
- 15.00–15.20** **Trends in permanent grassland cover in Latvia in the period from 2007 to 2016**
Pēteris Lakovskis, Solvita Rūsiņa
- 15.20–15.40** **Mapping and identifying grassland ecosystem services and their trade-offs: study from Baltic states**
Ivo Vinogradovs, Miguel Villoslada, Justas Gulbinas, Anda Ruskule, Kalev Sepp, Raimonds Kasparinskis, Oļģerts Nikodemus
- 15.40–16.00** **Coffee break**

POSTER SESSION II CHAIR: SOLVITA RŪSIŅA

- 16.00–17.00** *(YIP) Kristina Plenk, Matthias Krop, Olga Demina, Maria Höhn, Wolfgang Willner* Biogeography, diversity and phylogeographic analyses of Pannonian and western Pontic steppe grasslands – first insights into genetic diversity patterns
Lyudmyla Lysohor Halophyte grasslands of the Kirovohradska region (Ukraine)
Dalytė Matulevičiūtė Dynamics of *Carex depressa* ssp. *transsilvanica* population in the abandoned xerothermic grassland within 10 years
Dana Prižavoite, Baiba Strazdiņa, Edgars Bojārs Testing of different grassland restoration approaches in LIFE GRASSSERVICE project

16.00–17.00

Anneli Esko LIFE to alvar: Large-scale Estonian alvar grassland restoration in practice

Ivan Moysiienko, Sudnik-Wójcikowska B., Zachwatowicz M., Dembicz I., Zakharova M., Kuns B.

Old cemeteries as objects of preservation of steppe phytodiversity

(YIP) Iwona Dembicz, Ivan Moysiienko Kurgans in the southern Ukraine - islands of steppe in the “sea” of fields

Nina Polchaninova, Eugeny Karolinsky, Olga Filatova, Mikhail Filatov Sandy steppes of northeastern Ukraine as a prospective area of the European Emerald Network

(YIP) Olga Chusova Ecological differentiation of dry grassland vegetation communities within the Steppe zone of Central Russian Upland (Ukrainian part)

Svitlana Iemelianova, Dmytro Dubyna, Tetiana Dziuba, Taras Dvoretzkiy Semi-natural dry grasslands of steppe zone in Ukraine: issues and solutions

17.00–18.30

**Announcements of young investigator prizes
EDGG General Assembly, Closing ceremony**

9–11 JULY, SUNDAY-TUESDAY

POST-CONFERENCE EXCURSION

Meeting place - Academic Center for Natural Sciences, 1 Jelgavas Str.

9 July, 7.30–8.00 Registration for the post-conference excursion

8.00 Departure for the post-conference excursion

11 July, ca. 12.30 Return to Riga (1 Jelgavas Str.)

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KEYNOTE LECTURES

In hands of farmers and society: semi-natural grasslands in the boreal region

Irina Herzon¹, Guy Beaufoy²

¹ University of Helsinki, iryna.herzon@helsinki.fi

² European Forum on Nature Conservation and Pastoralism

The plight of semi-natural grasslands in the EU is well documented but we have much less understanding on how farming systems that make use of these grasslands are changing. Markets, policy, wider societal changes and culture have a decisive role in the use of biological resources, including semi-natural vegetation, within agricultural landscapes. I will summarize the established impacts of the EU policy on the semi-natural grasslands. I will proceed with an overview of the most recent policy developments of relevance, including the reform of the Common Agricultural Policy in 2013 with its “greening” elements, and discuss if we can expect it to contribute to conservation. We will look then at the evidence behind pros and cons for the key strategies for grassland conservation: the preservation strategy highlighting public values of the grasslands outside their production value, and transformation strategy that aims at strengthening and rediscovering the economic potential of the semi-natural grasslands. I will illustrate these with some implementation examples drawn from EIP-Agri Focus Group on Sustainable High Nature Value farming and ongoing HNV-Link project. Finally, I will outline tentative directions for future research in grassland conservation and policy.

Semi-natural grasslands in Estonia: importance, ecology and conservation efforts

Aveliina Helm

*University of Tartu, Institute of Ecology and Earth Sciences, Lai 40, 51005 Tartu, Estonia,
aveliina.helm@ut.ee*

Semi-natural grasslands are the most diverse ecosystems in Europe, harbouring number of plant species and associated animal species. Grassland biodiversity is linked with the provision of number of ecosystem services in agricultural landscapes, including pollination and biological pest control. During the past century, these unique, highly-valued habitats have undergone remarkable changes in environmental conditions and landscape-scale spatial configuration throughout Europe. In Estonia, semi-natural grasslands have lost 90% of their historical area. Decreased habitat area and reduced connectivity between remaining grassland patches have substantial influence on the persistence of grassland-specific biodiversity and related ecosystem services. In my talk, I will provide overview of the multi-trophic diversity of dry calcareous grassland ecosystems in Estonia and analyse the effects of habitat loss and isolation on the diversity and composition of several species groups, including agriculturally important pollinators, predators and parasitoid insects. I'll discuss the time-delayed responses of species diversity to changes in habitat spatial configuration, explore the susceptibility of species with different life-history traits and habitat specificity to landscape changes and analyse the effect of dispersal on maintaining and restoring grassland biodiversity.

In Estonia, mitigation measures against grassland loss include subsidized habitat management schemes and support for habitat restoration. In 2014, an ambitious grassland restoration project "LIFE to Alvars" was launched in Estonia with the help of EC LIFE+ Nature programme and Estonian state. Project aims to restore 2500 hectares of overgrown calcareous alvar grasslands by 2019. I'll provide overview of the activities carried out during the project and discuss the possible effects of landscape-scale restoration activities in maintaining the grassland species diversity and related ecosystem services.

ABSTRACTS OF TALKS AND POSTERS

Habitat selection of a steppic bird at multiple scales

Didem Ambarli

Department of Agricultural Biotechnology, Faculty of Agriculture and Natural Sciences, Düzce University,
Konuralp, 81620 Düzce, Turkey, didem.ambarli@gmail.com

Bimaculated lark *Melanocorypha bimaculata* is bird species known to breed across Asia Minor to Middle Asia. It is under-researched probably due to its absence from Europe and global least-concern status. To reveal breeding habitat requirements of the species, I made use of data from standard transect surveys, point counts and citizen-science data and conducted habitat suitability modelling with at three spatial scales: At national level i.e. Turkey, regional level (the Anatolian Diagonal and the southeast Anatolia) and local level. At the national level, climatic layers and landcover maps were used to link distribution of the species to environmental predictors. Maximum Entropy approach was applied by using MaxEnt software. Results showed that temperature seasonality and maximum temperature of the warmest month were the most important predictors at the national level. Arid and semiarid parts of Turkey were found to be suitable for the species.

At the regional level, I used transect data and compared used habitats in 500m buffer zone along survey transects with 500 available sites. There results showed that bimaculated larks prefer land mosaics composed mainly of arable lands and steppes and avoid densely forested sites. In addition, there is a high occurrence of the species in sparsely vegetated areas.

At the local level, I used abiotic, land-use and local vegetation parameters to reveal breeding habitat selection. Productivity of the site (NDVI), vegetation height and absence of trees played significant roles in presence of species. Species tend to occur on homogenous montane grasslands.

Acknowledgements: Thanks to Nature Conservation Centre (DKM) and Hilary Welch for sharing transect survey data of two regional projects, the Anatolian Diagonal Biodiversity Project and Southeastern Anatolia Biodiversity Project, respectively. Citizen science data were obtained from Kuşbank in which many experienced birdwatchers share valuable records of their surveys voluntarily.

Impact of grazing on feed values and mineral concentrations in mountain grasslands of Qilian Shan, NW China

Alina Baranova¹, Shunli Wang², Udo Schickhoff¹

¹ University of Hamburg, Institute of Geography, CEN Center for Earth System Research and Sustainability, alina.baranova@uni-hamburg.de, udo.schickhoff@uni-hamburg.de

² Academy of Water Resource Conservation Forest of Qilian Mountains (AWRCFQM), Gansu Province, China, wangshun123_78@163.com

The ability of natural grasslands to provide forage of sufficient quality is an important issue especially in mountain regions with arid climate conditions. Plants in arid environments are dependent on the seasonality in precipitation and temperature. In Qilian Mountains (Gansu province, NW China) most of the precipitation falls during summer season, when mountain grasslands are grazed by sheep, goats, and yaks. In order to estimate productivity of the pastoral lands, exposed to continuous grazing, herbaceous biomass was sampled from 1 x 1 m plot to analyze feed values (ADF, NDF, CP) and mineral concentrations (P, Ca, K, Mg, S, Mn, Fe, Zn) under differential grazing intensities with regard to maturity stage. We have sampled biomass during growing season 2012–2013 on pastures with spring/autumn or summer grazing pressure in two altitudinal zones (montane and alpine). The highest NDF values and the lowest CP values were found in plots most disturbed by grazing. No linearity was observed in the relationship between feed values and grazing classes. Concentrations of the minerals (zink, phosphorus, potassium, sulfur) significantly varied and showed maximum values in "slight" and minimum – in "destructive" grazing class, among them sulfur and phosphorus concentrations were found not sufficient to meet the diet requirements of the grazing animals.

Influence of different management treatments on functional diversity in the semi-natural grassland communities

**Silvia Bittnerová, Dobromil Galvánek, Monika Janišová, Eva Uhliarová,
Karol Ujházy, Mariana Ujházyová, Ingrid Turisová**

*Plant Science and Biodiversity Center, Slovak Academy of Science, Department of Geobotany; Ďumbierska 1;
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We studied the influence of different management regimes on functional composition and diversity of semi-natural grasslands of the *Violion caninae* alliance. In 2009, long term experiment was established, which concludes six management regimes – grazing (GR), mulching in combination with grazing (MUGR), mowing in combination with grazing (MOGR), mulching in autumn (MUAU), mulching in spring (MUSP) and non-managed plots (NM). We evaluated changes and development of functional trait representation during seven years of experiment. For analyses the community weighted means were used. Temporal changes in functional composition were evaluated by principal component analysis (PCA). Repeated measurements ANOVA was used to evaluate the effect of particular treatments in time on the functional traits. The most similar development from the functional aspect had the MOGR and MUGR plots which did not change markedly. The most significantly changed treatments represented MUAU and NM plots where continual decrease of Annuals, R-Strategists, Therophytes, Non-rosette plant was indicated. On the other hand, frequency of plants with vegetative type of reproduction and with vegetative reproduction organs has increasing tendency. During the first years of experiment MUSP plots had similar development like MUGR and MOGR plots, however in the last few years' functional diversity tended to the MUAU plots. A special case represents the GR plots because in last three years' intensity of grazing is decreasing and development of plots is similar to NM plots. The results suggest that mulching is an appropriate additional management treatment and is applicable in combination with another management treatment.

Phytodiversity and ecology of herbaceous vegetation in the buffer zone of Polistovsky Reserve (NW Russia)

Valentina Borodulina, Oxana Cherednichenko

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The object of our research is herbaceous vegetation (meadows and semi-ruderal herblands) on the territory of Polistovsky Reserve. Herbaceous communities are widespread in the European part of Russia and connected with human activity. In the forest zone they are comparatively small in size, and in recent decades without agricultural use grasslands deteriorate and become overgrown with forest. Herbaceous vegetation in the reserve is represented by abandoned meadows and semi-ruderal herblands in the places of former housing (villages, steadings, cordons) as well as managed (mowing and grazing) meadows. The aim of our study was to survey diversity of herbaceous vegetation in the buffer zone of Polistovsky Reserve (Pskovskaya province, NW Russia).

Vegetation classification was carried out according to Braun-Blanquet approach based on 211 relevés collected in 2012–2014. The data was processed using the Modified TWINSpan algorithm provided by the JUICE software, while ecological features of the syntaxa revealed were determined using ordination approach and phytosociological assessment (Landolt's scales).

The herbaceous vegetation of Polistovsky Reserve contains 245 species, 145 genera and 45 families of vascular plants, that is 46% of its whole reserve flora and accounts for 18% of the Pskovskaya province checklist. We found 5 rare species in herbaceous communities of Polistovsky Reserve. Of those, *Dactylorhiza baltica* (*D. longifolia*) is listed in the Red Data Book of the Russian Federation. The others are regionally protected (Red Data Book of Pskovskaya Province). The alien species pool consists of 9 species. We found 52 species of Bryophyta in herbaceous communities investigated: 50 species belong to Bryopsida, 2 species belong to Hepaticae. A preliminary classification scheme of herbaceous vegetation was suggested for the study area. We identified syntaxa from 4 classes: *Molinio-Arrhenatheretea*, *Phragmito-Magnocaricetea*, *Epilobietea angustifolii*, *Artemisietea vulgaris*. The ordination analysis demonstrated ecological features of the syntaxa. The leading differentiation factors were revealed: humidity, humus content, soil particles size, acidity of soil and soil nitrogen pool.

'Our *Molinia* meadows were walking away', Hydrological research used in Flemish grassland restoration project

Bram Cannaerts

NGO Natuurpunt, coördinator LIFE Hageland, bram.cannaerts@natuurpunt.be

The nature area, Dunbergbroek, is part of a Special Area of Conservation 'Valleien van de Winge en de Motte met valleihellingen (BE2400012)' of the Natura 2000 network. Dunbergbroek is historically known for its alluvial forests and nutrient poor valley grasslands such as *Molinia* meadows, *Calthion* grasslands and small sedge fens.

120 hectares is managed by nature organization Natuurpunt. Nevertheless, even on the managed sites, the last few decades these natural values have been slowly decreasing. The nature managers in the field had their assumptions on causes to blame: intensive drainage since the 20th century, peak flows and floodings with polluted surface water, arrival of a family of beavers in the area. But we wanted someone to take a good look at scientific collected data, to see what was happening.

The Research Institute for Nature and Forest (INBO) carried out a hydrological research to assist the implementation of the nature restoration project LIFE Hageland. In this research assignment potential locations for the restoration and development of mesotrophic alluvial forest and species rich groundwater dependent grassland were determined, as well as the required measures. Topography, hydrography and historical vegetation were studied in detail and combined with the currently available knowledge around the impacts of floodings.

This study confirms that the groundwater regime had shifted, even before the arrival of beaver. The abiotic conditions for *Molinia* meadow have moved some hundred meters upwards the valley. The watercourses have very different water quality, some watercourses discharge polluted and/or eutrophicated water for a large time of the year. It is advised to avoid flooding with this water through regular clearance of these water courses. Prolonged inundation with this water can lead to decomposition of organic material and a higher availability of nutrients (internal eutrophication). The extent at which polluted and eutrophicated sediment is deposited and is influencing habitat quality, is probably underestimated.

Other watercourses drain unpolluted seepage water and can be made less deep or be filled in to rewet the valley and make peat formation possible again. On locations where existing peat layers remain, the removal of the drainage (mainly smaller ditches) is necessary in order to sustain these layers. An area is designated where presence and activities of beaver can be tolerated (and could even be beneficial). Provided that certain considerations are made it is possible to sustain the core complex of nutrient poor grasslands, to reconvert forest to nutrient poor grassland and to create wet nature cores (with alluvial forest).

Changes of traditional management decreased functional diversity of poet's daffodil hay meadows: implications for conservation and restoration

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Hay meadows are an important component of the alpine landscape which evolved over millennia of human activities. However, western European mountains are undergoing an abandonment of agricultural practices, reflecting a post war trend of rural depopulation of isolated areas. When subjected to traditional management hay meadows are known to support high biodiversity. However, several studies showed that both intensification and abandonment can lead to a loss of species diversity.

In this study we focussed on the hay meadows where poet's daffodils form white carpets during the early-season blooming period, making the corresponding stands aesthetically very attractive. Moreover, poet's daffodil hay meadows represent a noticeable source of biodiversity and have a high nature conservation value but, on the other hand, they are threatened by both intensification and abandonment of traditional management. In view of that, we aimed to understand how floristic composition varies in relation to site conditions and changing land-use and what diversity metric can be useful for detecting the conservation status of these plant communities, with the purpose to address the preservation of the cultural heritage of these habitats.

This vegetation was studied through 26 phytosociological relevés, located in the eastern Alps (northern Italy), for which it was known the management type. Relevés were classified and analysed in relation to habitat features and taxonomical and functional diversity indices were calculated for detecting the conservation status of hay meadows subjected to different types of disturbance.

Poet's daffodil dominance brings together hay meadows showing a substantial range of floristic and ecologic variation and part of these stands could be referred to some habitat types regarded as priority for nature conservation according to the Interpretation Manual of European Union Habitats. In addition, functional diversity was negatively influenced by the land-use and can be profitably use for detecting the conservation status, with important implications for restoration measures aiming to preserve the value of these habitats. Finally, management-related variations in functional diversity suggested that the best practice recommended for conservation and restoration of this habitat is the continuation of traditional late mowing. This practice will allow preserving both biodiversity and ecosystem functions and services.

Ecological differentiation of dry grassland vegetation communities within the Steppe zone of Central Russian Upland (Ukrainian part)

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Presence of chalk outcrops within the Central Russian Upland determines the development of tomillares and “lowered alpine plants”, unique types of vegetation. It corresponds to the three alliances (*Artemisio hololeucae-Hyssopiion cretacei*, *Euphorbio cretophilae-Thymion cretacei* and *Centaureo carbonatae-Koelerion talievii*) that referred to the order *Hyssopetalia cretacei*. Syntaxonomical position of these groups is quite controversial, and if the first alliance communities are clearly distinct from steppe communities, the associations of second one are transition to the typical herb bunchgrass steppe (class *Festuco-Brometea*) and include a number of steppe species, therefore it is sometimes referred to order *Festucetalia valesiacae*.

For syntaxonomy and ecological assessment of these vegetation communities a comparative analysis of 236 geobotanical relevés of chalk outcrop vegetation and 222 relevés of steppe vegetation made from 1988 to 2016 on the territory of Ukraine within Kharkiv, Luhansk and Donetsk regions was carried out.

Analysis was based on the synphytoindication methodology using the ecological scales (Didukh, 2012). Analysis of 12 main ecological factors resulted in a clear separation of chalk vegetation communities from the steppe vegetation. The main driving factors were continentality of climate, light conditions, soil acidity, and carbonate content in soil. Based on cluster analysis the cumulative influence of ecological factors on the communities was estimated. Three clusters were separated. Alliances *Artemisio hololeucae-Hyssopiion cretacei* and *Euphorbio cretophilae-Thymion cretacei* were the most distinct, while the associations of the alliance *Centaureo carbonatae-Koelerion talievii* were more close to alliance *Marrubio praecocis-Stipion lessingianae*, and the meadow steppe communities (*Festucion valesiacae*) formed a third cluster. To assess the relationships between communities and ecological factors the DCA-analysis was done. In the DCA ordination diagram, the communities of the order *Festucetalia valesiacae* had the opposite position towards the order *Hyssopetalia cretacei* associations and differed by nitrogen content, soil humidity, variability of dampness, aeration of soil and humidity. Calcareous outcrop communities were distinguished by continental climate, light conditions, carbonate content in soil and acidity.

To conclude, despite the intermediate position of “lowered alpine plants” communities should be assigned to the order *Hyssopetalia cretacei* Didukh 1989, which includes calciphytic communities of the south-western shoots of the Central Russian Upland.

Changing of assembly rules during secondary succession: are there trends?

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Understanding the process of plant community assembly is crucial both for theoretical ecology and nature conservation. Probably random and non-random assembly process (so-called assembly rules) are working simultaneously. Recent reviews suggest to study the presence and strength of assembly rules along gradients, as it gives more information about the nature of the assembly process. Succession can be seen also as a gradient in time, however there are less study about assembly process in succession, especially there is a lack in long-term studies.

Our question was: How does the functional structure and assembly rules change during long-term secondary succession on old-fields? We conducted our research in abandoned agricultural fields on calcareous sand soil in the Danube-Tisza Interfluvies, Hungary. The community functional structure and the trait-based assembly rules were assessed with 40 permanent vegetation plots on old-fields which sampled in 2000, 2008 and 2010. The changes of the community weighted mean (CWM) of 10 traits were studied. The distribution of these traits was compared with a null-model and the effect of time since abandonment were tested with linear mixed effect models.

We found significant changes in functional structure during the succession. The distribution of 7 traits showed at least partly during the succession non-random pattern. Leaf size and leaf dry matter content (LDMC) switched from random to divergent pattern between 2000 and 2010. Life form and length of flowering period showed strong convergent pattern, while specific leaf area (SLA) and plant growth form became convergent from random with time. Distribution of seed weight and generative height remain random during the whole studied period.

Our results show that several assembly processes are working together at the same time, generating convergent and divergent trait dispersion pattern. Environmental filtering and limiting similarities act together, but have effect on different traits. In our case the traits connected with resource use effectiveness were controlled mainly by environmental filtering, while traits connected with resource storing were controlled mainly by limiting similarity. Beside these some traits, especially generative traits showed random pattern, suggesting that these traits are not so crucial in our case.

Mountain grasslands in central Greece

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Conservation of both forests and forest openings (grasslands and temporary ponds) at Mt. Oiti and Mt. Kallidromo (Sterea Ellada, Greece) is the main objective of the LIFE11 NAT/GR/1014 project FOROPENFORESTS. In order to establish the base status of the grasslands and transitions between grassland types and scrub, 8 transects (100 plots) were established at 6 localities of Mt. Oiti (1409–1925 m, flysch or dolomite) and 17 transects (190 plots) were established at 6 localities of Mt. Kallidromo (777–1296 m, flysch, limestone, tertiary deposits). Soil properties were also studied. A total of 254 plant species were identified, 119 on Oiti and 179 on Kallidromo, mostly dry and wet grassland species and also mountain heath species. Synanthropic vegetation species occurred mainly on Kallidromo where the invasive *Xanthium spinosum*, the only alien identified in the grasslands, was also found. Vegetation analysis resulted in 13 vegetation groups, clearly clustered in the higher altitude plots of Oiti and of Gkioza (1296 m) on Kallidromo (groups 1 to 8) and in the lower altitude plots of the other Kallidromo grasslands (groups 9 to 13). The vegetation groups with higher species richness were the ones of dry grasslands or of transition to dry grasslands. Evenness was generally high, 0.7 and above, and was highest in Oiti plots which represent transition to other vegetation groups or habitats (e. g. juniper heath and hedgehog heath). The most prominent life form was the hemicryptophytic while therophytes were more frequent in the dry and synanthropic grasslands of lower altitudes. Restricted distribution species such as Greek and Balkan endemics as well as Mediterranean taxa represented a lower percentage in the mountain grassland flora than in the general Greek flora. Notably five boreal or arctic/alpine species were identified on Oiti. Most plots on Oiti were assigned to the *Juncetea trifidi* including transitions to oro-Mediterranean scrub and *Festuco-Brometea* grasslands. The plots at Kallidromo were assigned to the *Festuco-Brometea* or *Molinio-arhenatheretea* including transitions to aquatic *Phragmito-magnocaricetea* communities. Most of the plots clearly belonged to the *Scorzoneretalia villosae* but the highest altitude ones showed affinities to the *Festuco-Brometalia*. The analysis of the detailed soil property data showed that altitude, pH, basic element content (exchangeable Mg, Ca, base saturation), parent rock, and available Fe and Mn were the factors affecting most the plot and species data.

Kurgans in the southern Ukraine - islands of steppe in the "sea" of fields

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The fragmentation and isolation of preserved habitat patches within intensive agricultural landscape threaten species survival in steppes. In Ukraine, <5% of the original steppe area has survived, mostly in nature reserves, loess ravines and kurgans (burial mounds). The latter are small, but relatively numerous objects. Nowadays kurgans located within large cropfields are threatened with ploughing. However, their role in maintaining steppe biodiversity can be relatively large if species inhabiting kurgans are proven to form metapopulations

Within the presented study we wanted to determine the most important landscape factors influencing species richness of steppe enclaves on kurgans taking into consideration the affinity of studied species to natural steppe ecosystems.

During ten years of intensive exploration we surveyed 112 kurgans located within the grass steppe of the southern Ukraine (Lower Dnipro Valley) completing their full species lists of vascular plants. Noted species were divided into habitat specialists and generalists according to their ecology in the studied region. Together with the floristic inventories we measured the diameter and height of studied kurgans and noted information on land use and the level of man-made disturbance of a kurgan. Additional landscape factors were obtained using GIS methods: the distance to the nearest large steppe enclave (loess ravine), human settlement as well as the amount of natural steppe in the surroundings of each kurgan.

We proved that the most important factor influencing the total species richness of studied kurgans as well as the species richness of both habitat specialist and generalist is the size of a kurgan. That relation followed a power law for all species and for habitat specialists. For the latter group very high z-value (more than 0.5) was observed. The relation of the number of generalists with the area of a kurgan was best explained by a logarithmic function. As the relation of species richness with a size of a kurgan explained more than 40% of variance for all three studied groups we decided to model the influence of other studied factors using the residuals of the abovementioned regression. Further analysis revealed that whereas the disturbance level was important for all species groups factors related to the level of isolation were more important for habitat specialist.

The obtained results suggest that the typical steppe species can form within the studied landscape metapopulations dependent on both large steppe enclaves as well as small islands of kurgans located within the "sea" of fields.

LIFE to alvar: large-scale Estonian alvar grassland restoration in practice

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Estonia has experienced a major loss of alvar grasslands (6280* Nordic alvar and precambrian calcareous flatrocks) in the past 40 years due to abandonment, forestation and inadequate grazing regime. Main threat to the alvar grasslands is overgrowing with junipers and pine trees after grazing has ceased. This has caused the loss of nearly 85% of the alvar habitat in Estonia: from 43 000 hectares in 1930s to 7 000 by now.

LIFE to alvars project is targeting the key areas of alvar habitat in Western Estonia aiming to restore 2500 hectares of alvars and re-establishing grazing in the restored areas. Restoration process of the overgrown alvar starts with the tree and shrub removal. Abandoned alvar grasslands are up to 80... 100% covered with junipers and pine trees and 10...30% of the trees and shrubs remain after the restoration process.

Main challenge of the project is to carry out the large-scale restoration work within the time frames of the project. To achieve that it was decided to use the forestry and agricultural machinery to carry out such a large-scale tree and shrub removal. There is little or no previous experience in alvar restoration using heavy machinery as this work has been done by hand (expensive and time consuming) previously. Four different types of machines were successfully tested and are now used in alvar grassland restoration process. In 2.5 years 60% of the targeted area has already been restored and the work is quicker, less expensive and with better quality compared to the restoration done by hand.

History of semi-natural grassland management in Latvia

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Historically, usage and management of grasslands depend on the development stage of animal husbandry. Semi-natural grasslands were used even before the emergence of animal husbandry, but the impact was negligible. Significant human impact on grasslands started at the beginning of the current era, when the usage of iron tools began.

The period of extensive agriculture was a time, when semi-natural grasslands were formed in the territory of Latvia. The process was influenced by a number of conditions. Firstly, all areas suitable for plowing were transformed into crop fields. Only areas, which could not be used as arable fields were utilized for grass forage production. Secondly, farmers tried to get as much benefit as possible from grassland without investing anything in it; pastures were grazed down to bare soil, and grass in meadows was mowed as close to the ground as possible. Thirdly, the process of hay producing maximized the spread of seeds over vast areas. Fourthly, such management continued for at least 700 years, until the beginning of the agricultural intensification period in the late 19th century.

Changes that occurred in agriculture of Latvia in the beginning of 20th century negatively affected the diversity of species in grasslands. Vast areas were cultivated and the forage production methods changed in remaining semi-natural grasslands. Seeds no longer had been distributed so intensely and in such vast areas.

ALL-EMA - Monitoring farmland species and in grassland and other habitats of the Swiss agricultural landscapes

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Semi-natural grassland as well as other species rich habitats in the Swiss farmland disappear. To stop this trend and to reach the agro-environmental targets, 400 Million Swiss Francs are currently paid per year to the farmers to use at least a part of their land in a biodiversity promoting way. What are the biodiversity trends in Swiss agricultural landscapes? Are the agricultural- related environmental objectives for the conservation of farmland species specifically in grassland habitats being met? Do the biodiversity promoting areas supported financially by the Swiss Confederation have the desired effects? To answer these questions, a long-term farmland species and habitat monitoring program was implemented entitled ALL-EMA. Indicators for different aspects of biodiversity, a habitat key for the reproducible assessment of habitats in the field and a specific sampling design focusing on habitats of interest including semi-natural habitats have been developed. 170 landscape segments of one square kilometre distributed along environmental gradients are sampled. The farmland habitat types are recorded in the field on a 50 m grid. A vegetation-based key allows the identification of 86 vegetation types which correspond to the Swiss Typology of habitats but also to European typologies. Floristic quality and vegetation structure are recorded. Vegetation surveys are conducted in a selection of habitats, weighting the sample towards the habitat types of specific interest for species and habitat conservation. ALL-EMA benefits from synergies with Biodiversity Monitoring Switzerland BDM. The ALL-EMA surveys are carried out in a selection of the systematically distributed 1 km² landscape segments of BDM. This allows faunistic indicators to be calculated using BDM butterfly and breeding bird data. Synchronious with the BDM, every year a fifth of the sample is recorded and in 2020, first results about the state of habitats in the Swiss farmland are expected.

ALL-EMA is integrated into the governments existing system of agri-environmental indicators and is designed to complement the current national monitoring programs with a focus on habitats of medium frequency to medium rarity, including all types of semi-natural grassland and others. It will provide over 30 indicators for the diversity and quality of species, habitats and biodiversity promoting areas in agricultural areas ranging from the lowlands to high-altitude summer pastures. The indicators provide information on the status of agricultural biodiversity and also on the degree to which agri-environmental measures achieve their objective of promoting biodiversity.

Semi-natural dry grasslands of steppe zone in Ukraine: issues and solutions

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Steppe vegetation during almost one hundred years is in the focus of many ecological problems associated with excessive plowing of landscapes (90%) and exhaustive using of phytoresources, in the past decade – with the losing of floristical and coenotic diversity (Econet of steppe zone of Ukraine, 2013). The most communities of dry grasslands in the steppe zone of Ukraine are semi-natural. They are preserved mostly on the rivers slopes and beams. Despite the excessive transformation of the territory these communities are characterized by the high syntaxonomical diversity and represented by 117 associations which belong to 4 classes (*Festuco-Brometea*, *Festuco-Puccinellietea*, *Festucetea vaginatae*, and *Koelerio-Corynepforetea*). The highest syntaxonomical richness has *Festuco-Brometea* class (73 associations, 14 alliances and 2 orders) (Dubyna, Dziuba, Iemelianova, 2017). Dry grasslands are exposed to excessive human impact, in particular grazing, spontaneous fires, terracing and forest planting of the slopes and recreation. Formation of the national ecological network of Ukraine is the most effective method of natural and semi-natural dry grasslands` preservation. According to the "Law of Econet of Ukraine" (2004) on the territory of econet's elements economic using of natural resources are limited. Implemented experimental researches on the projected key areas of the Azov-Black Sea ecological corridor convincingly argue the necessity of intervenes in the processes occurring in natural protected areas, including beyond the absolute conservation ones, to preserve the existing syntaxonomical and floristic diversity and its augmentation. The last position should be the paradigm of environmental policy and one of the main objectives of environmental institutions. Extraction certain amount of plant material regulated by mowing, grazing and, if it is necessary, winter burning herb stands in our opinion is the solution of this extremely important problem. These actions should be preceded by valuation of the negative changes and their trends, and also thorough control over their implementation. The conducted investigations covered only vascular plant, their communities and resources. Till now the present state of the spore plants and fungi in absolute reserve regime and their reaction to the separation of certain biomass remain out of consideration. Also equally important is the establishment of their behavior in the use of the proposed methods of regulating biomass. In the scientific aspect the studies of changes occurring due to the impact of new anthropogenic factors in conditions of varying degrees of conservation should be continued.

GrassPlot database - a collaborative initiative within the framework of the Eurasian Dry Grassland Group (EDGG)

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The Database of Scale-Dependent Phytodiversity Patterns in Palaearctic Grasslands (GrassPlot) was established in March 2017 as repository of multi-scale and multi-taxon sampling data in precisely delimited plots with extensive environmental measurements. The GrassPlot database aims at complementing existing broad-scale vegetation databases (EVA, sPlot) and facilitation of grassland research and its applications in nature conservation and ecological restoration.

As of 1 April 2017, GrassPlot contained 25,374 vegetation plots of different sizes (0.0001; 0.001 ... 1000 m²) and 1,026 nested plot series with at least four different grain sizes. The included data from 79 projects and 106 data owners, who constitute the GrassPlot Consortium. The plots are located in about 30 different countries and represent a wide range of different vegetation types. The GrassPlot Consortium is planning a series of papers using the common database for addressing basic ecological questions to our understanding of community assembly rules and diversity patterns in one of the most extended biomes on Earth.

The data collected during the EDGG Research Expeditions/Field Workshops contribute a substantial part of GrassPlot database. The EDGG sampling methodology has been published recently to gain new supporters and become widespread. The main achievements of this successful EDGG initiative will be introduced during the lecture.

From goals to action! – an action plan for management of semi-natural grasslands in Finnish conservation areas completed

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There is about 45 000 ha of semi-natural grasslands and natural pastures in Finland, about half of them in protected areas. Management of semi-natural grasslands and natural pastures is among the most vital actions for maintaining the biodiversity in Finnish nature. In protected areas, only about half of the known semi-natural grassland (12 000 ha), are managed at the moment. Grazing is the most common management method, but mowing is also carried out. The management is in most cases carried out by local farmers, in co-operation with the environmental authorities with the CAP as their primary source of funding. Metsähallitus Parks & Wildlife Finland is the manager of state-owned land in the conservation areas and is the authority renting the areas to local farmers for grazing. Metsähallitus is also in many areas responsible for co-ordination of management actions in privately owned conservation areas.

In 2017 a national action plan for management of the semi-natural grasslands in Finnish conservation areas was completed. The work is based on a comprehensive analysis of existing and potential areas in a national GIS-system for protected areas. In the action plan the most important new actions for the coming years until 2025 were lined out, as well as guidelines for continuous management actions. To achieve the biodiversity conservation goals, the action plan states that the amount of managed areas should be increased with 4000 ha at the same time as the quality of the management in the areas already managed should be increased. New management areas should in first place be established at sites with high biodiversity values (threatened species, Natura 2000-biotopes) and sites with high relevancy from a network perspective. The co-operation with local farmers, organizations and authorities is also to be strengthened.

Origin of steppe flora and fauna in inner-Alpine dry valleys

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The continental climate of Central and Western Asia shaped the largest continuous grassland ecosystem of the planet, the Eurasian steppe belt. In contrast to this large, originally continuous, zonal steppe, smaller patches of steppe also emerged in temperate Europe, favored by local climatic and edaphic factors. These extra-zonal steppes occur for example in large mountain chains such as the European Alps. Like other extra-zonal steppes, Alpine steppes are insular and often species-rich habitats of high conservation value. They share parts of their biota with Eurasian zonal steppes, implying periods of temporal connectivity during Pleistocene climatic oscillations. However, the origin, immigration history, and past range dynamics of Alpine steppe biota are currently unknown. A comparative phylogeographic approach combining restriction site associated DNA sequencing (RADseq), plastid and mitochondrial DNA sequencing, and species distribution modeling was applied to six representative plant and insect taxa. We found congruent and deep phylogenetic splits between biota of zonal Eurasian steppes and extra-zonal European steppes. Our analyses further revealed strong genetic structuring and high phylogenetic diversity within the extra-zonal steppe biota of Europe. Especially Alpine steppes harbored private and largely derived lineages. Species distribution projections into the past reflected a complex postglacial history of extra-zonal steppe biota, suggesting postglacial recolonizations from multiple refugia and rapid niche expansions, while a continuous steppe belt spanning Eurasia during the last glacial was not supported. Our results support an independent evolutionary history of European steppe biota and challenge traditional biogeographic hypotheses that considered them to be young relics of their zonal occurrences. We emphasize that the phylogenetic diversity within European steppes might be larger than within their zonal counterparts. Hence, our findings raise the conservation value of extra-zonal steppes and could act as game changer for dry-grassland conservation management in Europe.

Coenoflora of *Trachomitum venetum* (L.) Woodson subsp. *sarmatiense* (Woodson) Avetisjan in the Sea of Azov coastal zone

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The flora of the Sea of Azov coastal zone currently has 1944 species of vascular plants of 620 genera, 124 families and 4 divisions. In total, 265 rare taxa are known from the territory. One of them is *Trachomitum venetum* subsp. *sarmatiense*, which is listed in the third edition of the «Red Data Book of Ukraine» (2009).

Natural habitat of *Trachomitum venetum* subsp. *sarmatiense* is Eastern Mediterranean. It covers the coasts of the Black Sea and the Sea of Azov, including coastal areas of Bulgaria, Turkey, Russia and Ukraine (Kolomiychuk, 2012).

At present we know two populations of *Trachomitum venetum* subsp. *sarmatiense* in Pryazov'ya region, common for wet, marshy, saline ecotopes. One of them is from Samsonova Spit (Donetsk region) and the other is from Verbova Spit (Russia, Krasnodar region). Rarely they are recorded in a range of sea coast dune. The species is marked within two classes of vegetation – *Festuco-Puccinellietea* Soó ex Vicherek 1973 and *Ammophiletea* Br.-Bl. et R.Tx 1943.

Coenoflora of these communities includes 52 species of vascular plants of 42 genera, 19 families, 2 classes, 1 division. The greatest species diversity in researched coenoflora have families Asteraceae (16 species), Poaceae (9), Apiaceae (3), Brassicaceae (3), Fabaceae (3). 4 families contain 2 species each, and 10 families – 1 species each.

By biomorphological signs the studied coenoflora is dominated by perennial grasses (57.8 %). Within monocarpic plants biennial plants prevail (17.3 %), followed by annual plants (15.4 %). The part of woody biomorphs in this coenoflora is small (9.5 %).

By ecologic and coenotic signs this coenoflora is dominated by species of synanthropic ecologic and coenotic group (34.6 %), which is primarily due to the impact of natural and anthropogenic factors on habitats. Group of littoral plants ranks second (25.0 %). Next in descending order meadow (17.3%), marsh (11.5 %), steppe (5.8 %) and halophytic (5.8 %) groups come.

Geographically the studied coenoflora is dominated by species of Holarctic (36.5 %) and Eurasian Steppe (23.1 %) types of habitat. Rarely there are marked species of Old Mediterranean Eurasian steppe (19.3 %) and European Mediterranean (17.3 %) types of habitat. Old Mediterranean and cosmopolitan types of habitat have 1 species each (3.8 % together).

Protection of Northern Pryazov'ya population of *Trachomitum venetum* subsp. *sarmatiense* causes concern because it is located in the battle zone. We have developed a system of measures for settlement of the species from other populations on Bilosarayska and Berdyanska spits.

Spontaneous grassland vegetation of the garden and park landscapes of the Middle Bug region (Ukraine)

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Grassland communities as a part of spontaneous vegetation play a significant role in gardens and parks plant cover. They can be used to indicate environmental quality in urban ecosystems as biological monitoring facility.

The aim of the work was to provide an inventory of syntaxonomical diversity of spontaneous grassland vegetation of garden and park landscapes in the Middle Bug region and to reveal their ecological and cenotic peculiarities.

The material for the study were 67 relevés of grassland vegetation made during 2007–2016 in dendrological parks, botanical garden and monuments of landscape art in Vinnytsia and Cherkasy regions of Ukraine (12 parks in total). The relevés were stored in the TURBOVEG database (Hennekens, Schaminee 2001). The nomenclature of higher vascular plants followed S. K. Cherepanov (1995). The data analysis was performed in the JUICE program (Tichý, 2002). The obtained vegetation units were identified using Ukrainian (Solomakha, 2008) and foreign (Chytry et al. 2009) sources. Phytoindicative evaluation of the units were made in the JUICE program using Didukh ecological scales on 12 environmental factors: Hd (soil humidity), fH (variability of damping), Rc (acidity), SI (total salt regime), Ca (carbonate content in soil), Nt (nitrogen content), Ae (aeration of soil), Tm (thermal climate), Om (humidity), Kn (continental climate), Cr (cryo-climate), Lc (light) (Didukh 2011).

The syntaxonomy of studied vegetation includes 3 classes of grassland vegetation: *Festuco-Brometea* (*Festucetalia valesiaca* order, *Festucion valesiaca* alliance); *Polygono arenastri-Pöetea annuae* (*Polygono arenastri-Pöetalia annuae* order, *Polygono-Coronopodion* and *Saginion procumbentis* alliances); *Molinio-Arrhenatheretea* (*Galietalia veri* order, *Trifolion montani* alliance and *Arrhenatheretalia elatioris* order, *Cynosurion cristati* alliances). Peculiarities of environmental differentiation of the syntaxa are revealed.

Grassland habitats of the European importance in Ukraine: identification and inventory

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The signing of an association agreement between Ukraine and the EU has opened up great prospects for improvement of national environmental legislation and bringing it closer to European standards. This challenged the research related to the methodological framework for identification and inventory of habitats listed in Resolution 4 of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and Annex I of Council Directive 92/43/EEC (Habitat Directive). The list of habitats from Resolution 4 for Ukraine was approved by the results of two biogeographical seminars. It includes 18 habitat types belonging to category E "Grasslands and lands dominated by forbs, mosses or lichens". The list of habitats from Annex I was prepared as a result of discussions at the round table involving a wide range of experts. Grasslands are represented in this list by 17 habitat types with category 6 "Natural and semi-natural grassland formations". Taking into account that a lot of vegetation data has accumulated now in Ukraine, including relevés of grasslands communities, the possibility of using of phytosociological databases, in particular Ukrainian Grassland Database, was considered for inventory of habitats listed in Annex I of Habitat Directive and Resolution 4 of Bern Convention. According to the results of this work in total 2251 grassland relevés were identified, representing the habitats listed in the Resolution 4 and 1767 grassland relevés that corresponds to the habitats from Annex I. However, interpretation of relevés as certain habitat types based on their syntaxonomy and lists of characteristic species, provided in the relevant interpretation manuals can cause quite considerable difficulties especially for dry grassland habitat types. That is why the characteristics of the habitat types in the existing manuals need a certain correction so that they can be effectively used to interpret relevés from Ukraine. The preliminary structure of the Emerald Network of Ukraine was approved in December 2016, which is mainly based on the existing protected areas. However, work is underway to develop a shadow list of Emerald sites based on inventory of species and habitats from resolutions of the Bern Convention and annexes of Habitat Directive. In order to ensure that this environmental network has legal force and could function effectively, the draft of the Law of Ukraine "On conservation of natural habitats and wild fauna and flora of European importance in Ukraine" is being prepared.

Halophyte grasslands of the Kirovohradska region (Ukraine)

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The Kirovohradska region (Ukraine) is located in the center part of Ukraine, in the Cisdnieper Upland, in the territory between the Dnieper and the Bug rivers. Topology Cisdnieper Upland dissected by river valleys, arroyos and gullies. Zonal vegetation is preserved on the territories unsuitable for agricultural use. Halophytic grasslands are mainly confined to the bottoms of the arroyos with soil salinity. The plant communities are investigated within the arroyo «Razvorina» referred by us to the association *Festucetum regelianae* V. Solomakha et Shelyag 1984. The community is confined to moist soils salinity. Among the Poaceae the most represented are *Festuca regeliana* Pavlov, *Elytrigia intermedia* (Host) Nevski, *Agrostis stolonifera* L. In addition, the high abundance of *Carex distans* L. was noted. Some species of forbs – *Achillea pannonica* Scheele, *Althaea officinalis* L., *Nepeta pannonica* L., *Daucus carota* L., *Lactuca saligna* L. had a noticeable role in the composition of plant communities. The family of the Fabaceae was represented by *Trifolium pratense* L. and *T. montanum* L., which have high constancy. The projective cover of the herb layer varied from 75 to 95 %. Species richness was 36 species per 100 m². The moss layer projective cover was 1–3%, formed by *Brachythecium albicans* (Hedw.) Bruch et al. Weed species *Ambrosia artemisiifolia* L., *Artemisia absinthium* L., *A. vulgaris* L., *Berteroa incana* (L.) DC., *Carduus acanthoides* L., *Conyza canadensis* (L.) Cronquist. were common indicating the influence of farmland closeness and recreational pressure.

Grazing abandonment results in decline of zoo-choric species – an evidence from dark diversity analysis in Central European grasslands

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Central European semi-natural grasslands evolved during the last millenia thanks to grazing of domestic animals, like cattle, sheep, goats or horses. Not only the pastures but also hay meadows have usually been regularly grazed during certain period of the year until the first half of the 20th century. Grazing domestic animals not only forced the genesis of Central European semi-natural grasslands but also influenced the species composition by selection, providing germination gaps and different microsites or dispersal of diaspores.

We asked, if it is possible to estimate the effect of grazing abandonment on the observed species decline. Although it is rather easy to compile a set of plant traits which reflect species adaptation to grazing, we suppose, that the impact of grazing and grazing abandonment would be proven more directly by comparing the proportion of species dispersed exclusively by domestical animals. For this purpose, we used large phytosociological data sets from two intensively investigated regions of south-eastern Austria (Styria) and central Slovakia (Poľana Mts).

We compared community weighted means of epi- and endozoochoric species in different grassland types and sampling periods and detected only minor differences in some cases. Then we calculated the co-occurrence-based dark diversity (Beals smoothing) of recent relevés using a set of historical relevés recorded in the same region. We tested this approach by comparing relevé pairs from permanent and semi-permanent plots resampled after 15–20 years following the original sampling. The results show, that the observed species loss was matching the dark diversity species list calculated at a threshold of 0.2 by about 70%.

Then we calculated dark diversity for the recent relevés from a set of ecologically similar historical relevés of the region by setting the threshold to 0.5 to avoid positive mismatches. With increasing threshold value the proportion of zoochoric species in the dark diversity species list increased reaching over 70% at the threshold of 0.5. We conclude that this rather simple method can help to estimate the importance of grazing for plant diversity conservation in contemporary Central European grasslands. Moreover, we suppose that the co-occurrence-based dark diversity calculated from historical data sets could help to detect also other drivers of species loss at the landscape level.

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Dynamics of *Carex depressa* ssp. *transsilvanica* population in the abandoned xerothermic grassland within 10 years

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The range of *Carex depressa* ssp. *transsilvanica* includes Central and South Europe, and Western Asia. The only locality of this taxon in Lithuania is the most northern point in its range. The Lithuanian population is situated in the south-eastern part of the country. The habitat is xerothermic grassland on the steep slopes of the hill. At the end of the last century, the habitat was transformed into sown meadow, which later was abandoned. *Dactylis glomerata*, which dominated in the grass layer of the sown meadow, perished during naturalization. In 2007, on the bottom part of the southwest facing slope in the gaps of the plant cover, two individuals of *Carex depressa* ssp. *transsilvanica* were found. The aim of the study was to evaluate the recovery of *Carex depressa* ssp. *transsilvanica* population in the naturalizing abandoned grassland.

The study of *Carex depressa* ssp. *transsilvanica* population was performed in 100 m² permanent plot in 2007, 2009, 2010 and 2016. The coverage (%) of the layers and all species was evaluated. *Carex depressa* ssp. *transsilvanica* plants were counted and age stages (after Gatsuk et al., 1980) were determined in twelve 1 m² sized permanent plots.

The coverage of the herb layer increased from 80% in 2007 to 96% in 2016. The bryophyte cover tended to rise during first two years, however, later it decreased due to thickening of the herbaceous plants. The growth of solitary shrubs was hindered due to gnawing by European roe deer. In spite of slight changes in the total number of species, the species composition changed significantly (Sørensen's coefficients did not reach 0.5). During the investigation period, the abundance of *Dactylis glomerata* constantly declined and plants of this species became stunted, while the coverage of *Briza media* increased considerably and became the obvious dominant of the herb layer. The total number of *Carex depressa* ssp. *transsilvanica* individuals increased in the sparse herb layer, while decreased in the dense. Considerable changes in the structure of age stages were determined during the survey period: in the sparse herb cover juvenile and young reproductive plants prevailed, while in the dense herb layer only mature reproductive and subsenile *Carex depressa* ssp. *transsilvanica* plants occurred. Due to the absence of gaps in the vegetation cover, the population of this taxon can perish.

Long-term changes in species richness of flies (Diptera, Brachycera) in grassland communities of Engure Nature Park, Latvia

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Long-term studies of changes in numbers and species richness of flies (Diptera, Brachycera) in the Lake Engure Nature Park (LENP) have been performed during 1995–2012 within the framework of the National Long Term Ecological Research (LTER) network of Latvia. One of the aims of the study was to find out effects of climate warming on species diversity of grassland insect communities. Insects were collected three times per season (June, July, and August) by entomological sweep net from six different grassland sample plots: dry grasslands with sparsely standing trees – Cl. *Koelerio-Corynephoretea* All. *Plantagini-Festucion* (S1); almost permanently humid grassland – Cl. *Scheuchzerio-Caricetea fuscae* All. *Caricion davallianae* (S2); white dune overgrowing with perennial herbs on dry sandy soil – Cl. *Ammophiletea* All. *Ammophilion*; flood-plain calcareous fen – Cl. *Scheuchzerio-Caricetea fuscae* All. *Caricion davallianae* (S8); humid calcareous grassland – Cl. *Molinio-Arrhenatheretea*, All. *Molinion* (S9), and humid grassland – Cl. *Scheuchzerio-Caricetea fuscae* All. *Caricion fuscae* (S10). In 1995 herbivores (wild cows and Konik horses) were introduced to the S9 and S10 in order to prevent overgrowing of grasslands by bushes. No statistically significant trends were found in fly communities of studied grasslands except in S9 and S10 where a sharp increase of species richness of flies took place after the introduction of large herbivores. High numbers of animals, grazing, trampling and manuring the site might have affected insect communities of these sample plots. The most pronounced increase was observed in saprophagous flies. These habitats showed the highest total numbers and species richness of flies (S9 – total numbers 2182, species richness 142; S10 – total numbers 1884, species richness 151). In general, the highest numbers and species richness of flies was found in dry habitats S1 (total numbers 1191, species richness 108), and S5 (total numbers 1694, species richness 129). Wet grasslands had much lower numbers and species richness of flies (S2 – total numbers 814, species richness 78; S8 – total numbers 985, species richness 86).

Old cemeteries as objects of preservation of steppe phytodiversity

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The steppe is among the most endangered biomes of the world, especially in Ukraine, where more than 95% of the original steppe has been destroyed due to conversion into croplands, afforestation, construction of buildings and other human activities. Because of socio-economic changes over the past centuries, steppe vegetation is now often restricted to places inadequate for ploughing, such as ancient cemeteries. We have commenced study of the plant cover of cemeteries in southern Ukraine. Our pilot studies near 20 old cemeteries have shown that they are important places for the preservation of steppe phytodiversity. Steppe plant cover in old cemeteries are the remains of 'virgin' steppe landscapes, which were the dominate land cover here until the end of the 18th century. By the beginning of the 20th century, the steppe had almost completely been converted into agricultural land, with the exception of land, near villages, which had been set aside for cemeteries before the conversion to agricultural land. In other words we are studying cemeteries that were created during the colonization of the south of Ukraine on the part of the Russian Empire. Earlier cemeteries, created during the Ottoman or Tartar era have (unfortunately) not been preserved. Today, cemeteries are surrounded on all sides by anthropogenic landscapes – settled landscapes, or on the borders with settled and agricultural landscapes. Sometimes, steppe plant cover can be found in isolation inside agricultural landscapes. The long term preservation of steppe plant cover in cemeteries is facilitated by the fact that cemeteries are traditionally a place where a range of activities that lead to the destruction of the plant cover is prohibited (with the obvious exception of burials). Also, the preservation of certain steppe flowers is facilitated by the fact that they tend to be cultivated near graves (for example, *Iris pumila* L.). However, invasive species have also enriched the plant cover of cemeteries. Still, in old cemeteries, we have found a significant number of indigenous, steppe and non-synanthropic plants. A clear example of the preservation value of old cemeteries is the observed growth in them of sozophytes. In particular, we have found the following sozophytes in studied cemeteries: *Astragalus heningii* (Steven) Klokov, *Ephedra distachya* L., *Limonium platyphyllum* Lincz., *Stipa capillata* L., *S. ucrainica* P. Smirn., *Vinca herbacea* Waldst. et Kit., etc.

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Invasive grassland species *Elaeagnus angustifolia* on the northern and western boundaries in Ukraine

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According to the reports of the international work program Millennium ecosystem assessment (2005), more than 60% of the world natural ecosystems are already degraded. One of the main direct factors of the biodiversity loss is invasions of the adventive species.

Ukraine has a rather high level of flora adventization; in particular, 14% of the general plant species number is presented by adventive species. One of such adventive species is *Elaeagnus angustifolia*. It is a transformer species of a high invasiveness level, which can spread through the anthropogenically transformed and semi-natural places of growth that suppresses regeneration of the aboriginal species.

The aim of this research is to analyze age and morphological structure of the northern and western populations of *E. angustifolia* on the edge of its area in the Right-Bank Ukraine that defines potential abilities and scale of the threat of natural expansion. We chose five populations on the edge of species area and analyzed their age structure and main morphological parameters such as height, diameter, branchiness, and crown diameter.

The results indicated that invasive *E. angustifolia* is widespread in the Steppe zone and actively expands its area and population size within the Forest-Steppe zone, penetrating as separate loci into the Forest zone. There are two passages of endozoochoric seed dispersal: from plantations and from natural wild populations. The analysis of age structure reflects their different potential. All northern populations are regressive or stable but the western population is young and progressive. Most of the populations do not have juvenile age stages. Basing on the annual gain data, we determined the age of each stage. Statistical analyzes demonstrated the high dependence for all morphological parameters. It is logarithmic for diameter-height, height-age, diameter-crown diameter, height-branchiness, diameter-branchiness, and crown diameter-age relations. Linear relation is observed between height and crown diameter, age and branchiness.

Received results of age and morphometric evaluation are significant for the prediction of further changes in the population structure of *E. angustifolia*, for modelling of the general population development of the species, and for the formation of coenoses with *E. angustifolia*.

***Symphyotrichum* species possess potential threat to meadow habitats**

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The genus *Symphyotrichum* is represented by six alien species in Lithuania. Most of *Symphyotrichum* species, e. g. *S. lanceolatum*, *S. novi-belgii*, *S. × salignum*, etc., occupy mesic and humid natural (various riparian habitats, meadows, grasslands, etc.) and anthropogenic (roadsides, wastelands, ditches, etc.) habitats. Besides, *S. dumosum* can occur in very contrasting habitats compared to its relatives, i.e. both in sandy meadows, xerophilous forest edges or in wet and even humid meadows of purple moorgrass (*Molinia caerulea*) on heavy clay soils.

Field investigations were conducted in 2014–2016 and a total of 32 populations of *Symphyotrichum* were studied in Lithuania. In each study area, phytosociological relevés were made and coverage of each vegetation layer was identified. Also the number of shoots of *Symphyotrichum* species was recorded.

Results of the investigation on *S. lanceolatum* populations revealed that this species possess certain features of invasiveness. Negative statistically significant correlation ($r = -0.47$; $p = 0.0005$) was found between the coverage of native herbs and the coverage of *S. lanceolatum*. Even stronger features of invasiveness of *S. dumosum* were revealed. Negative statistically significant correlation ($r = -0.66$; $p = 0.00007$) was found between the coverage of native herbs and the coverage of *S. dumosum*. Other studies revealed that negative effects of an invader correlate with its own population density, since any biomass controlled by the invader constitutes resources no longer available to other species.

After the invasion of *S. dumosum* and *S. lanceolatum*, further degradation of meadow habitats occurs because of the increase of ruderal species. Only *Viccia cracca*, being a climber, appears to be the most resistant native species to the impact of *S. dumosum*, while other species are outcompeted.

Mesic grasslands and tall herb fringe grasslands are the most prone to invasion of *Symphyotrichum lanceolatum* and *S. × salignum*, whereas meso-xerophile grasslands are the most susceptible to invasion of *S. dumosum*.

Biogeography, diversity and phylogeographic analyses of Pannonian and western Pontic steppe grasslands – first insights into genetic diversity patterns

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Throughout the Quaternary, steppe grasslands have represented a dominant vegetation cover across vast European landscapes, harbouring nowadays only remnant habitats for many rare species, especially in Central Europe. However, the (local) continuity of the species and the floristic composition of these refugial grasslands still remain unclear.

There are several hypotheses available, where thermophilous steppe species – which occur in the Pannonian and western Pontic grasslands today – survived during the Last Glacial Maximum. Areas along the Black Sea coast or southern slopes of the hills surrounding the Hungarian Plain are, for instance, considered as potential source areas for a (re-)colonisation of the central Pannonian region. Beside environmental factors also species-specific dispersal and colonisation ability are limiting factors of species' current distributions. Therefore, the geographic distance to potential glacial refuge areas might be a better indicator of regional species richness than actual environmental conditions.

To evaluate the differences of steppe species (co-occurring in different steppe grasslands) in their response to glacial survival and post-glacial migration, we aim at identifying patterns of regional species diversity, areas of endemism, and genetic diversity using a set of 12–15 grassland species for molecular analyses (i.e. cpDNA sequence data). Selected species are characteristic for the three main types of steppe grasslands (i.e. *Brometalia erecti*, *Festucetalia valesiaca*, and *Stipo-Festucetalia pallentis*) determined in a preceding higher-level classification of *Festuco-Brometea* throughout the whole Pannonian region. Patterns of intraspecific genetic structure will give further insights into long-term in-situ persistence in refuges and routes of migration between potential refugial areas and present-day occurrences. Here, we will present first results from the genetic part of our project, illustrating genetic diversity patterns of a subset of our study species.

Reaching the (north)western distribution limit in Central Europe – a phylogeographic transect study on the genetic constitution and fitness of steppe grassland species

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In our study, we used an east-west transect representing the distribution range periphery of different steppe grassland species in Central Europe to analyse their genetic structure and diversity patterns, performance, and biogeographical history. This transect explicitly represents the absolute distributional limit of most investigated taxa, which typically show a more widespread continuous distribution in the eastern region (Pannonian Basin, Hungary), compared to populations at the boundary of this continuous Pannonian occurrence (Eastern Austria) and the (north)westernmost exclaves in western Germany (especially in Rhineland-Palatinate).

Referring to theories like the “Abundant Centre” hypothesis and the “Central-Marginal-Model” we assume more isolated and individual-poor populations at the absolute (north)westernmost distribution range limit and therefore, possibly reduced fitness, increased among population differentiation and decreased within population diversity. All study species, namely *Adonis vernalis* (Ranunculaceae), *Carex supina* (Cyperaceae), *Inula germanica* (Asteraceae), *Linum flavum* (Linaceae), *Oxytropis pilosa* (Fabaceae), and *Poa badensis* (Poaceae), are rare and endangered in Central Europe. We used Amplified Fragment Length Polymorphisms (AFLPs) and chloroplast (cp) DNA sequence data to analyse patterns of genetic diversity and structuring from four representative populations per study region and species. Plant fitness was investigated based on the same populations using different field performance parameters like fruit set and mass, as well as germination rates estimated under standardized conditions.

Results from the fitness analyses indicate marked differences among study species and regions, but do not clearly support the idea of reduced performance towards the absolute (north)western distribution range limit. Depending on the species surveyed, other factors like life history traits (notably, clonal growth) and/or variation in population size have a greater impact on plant performance parameters. The observed genetic patterns (AFLPs & cpDNA) partially support the expectations: AFLP data group samples predominantly according to their geographical origin, i. e. reflecting the three study regions, a pattern interpreted as biogeographical vicariance. However, with respect to the extent of population differentiation and the partitioning of genetic diversity, again no study species follows all of the hypotheses as assumed. We have therefore to conclude that the phylogeographic patterns observed within our study transect are mostly reflecting species-specific traits and histories, which often mask the species’ occurrence at the distribution limit.

Sandy steppes of northeastern Ukraine as a prospective area of the European Emerald Network

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An area of sandy dunes and sandy steppes on the ancient terrace of the Siverskyi Donets River about 50 km east of the City of Kharkiv is called "Kharkiv desert". It is a hotspot of rare animal species. Seven of them are listed in the Red Data Book of Ukraine and 33 species in the Regional Red Data Book.

Butterfly list includes 60 species, about a half of the regional fauna. Two species, *Polyommatus eros* and *Hipparchia statilinus*, are near threatened (NT) on the European level, and both are endangered at the Ukrainian level (the former is critically endangered).

About a hundred of bee species, 35 wasp species are recorded from the study site. *Anoplius samariensis* and *Hoplitis fulva* are included in the Red data Book of Ukraine as endangered and *Sphex funerarius* as not determined. The northern boundaries of the geographic ranges of *H. fulva* and the true bugs *Menaccarus arenicola* and *Vilpianus galii* run along the Kharkiv sands. In northeastern Ukraine, these species occur only in sandy habitats.

Spider species list is quite short, 62 out of 423 for the Kharkiv Region, but 18 of them (29%) are regionally rare. Two species are at the western boundaries (*Mustelicosia dimidiata*, *Xysticus mongolicus*) and one (*Yllenus vittatus*) at the northern boundary of their ranges. In the study area, these species are sandy grassland specialists. For one species (*Haplodrassus bohemicus*), the Kharkiv sands is the northernmost locality in the East European Plain, and for 11 species it is the only known locality in northeastern Ukraine.

Floristic research is at the initial stage. Two species (*Stipa capillata* and *Pulsatilla pratensis*) are included in the Red Data Book of Ukraine, and another three species (*Koeleria sabuletorum*, *Jasione montana*, *Linum austriacum*) are regionally rare. One formation (*Stipeta capillatae*) is included in the Green Book of Ukraine. The plots of forb-bunchgrass-shrub steppe on sandy soil correspond to the definition of endangered natural habitats (F3. 247) of the Bern Convention.

Sandy habitats of the studied area are well preserved. They host a number of rare and endangered species and can be a valuable site of the Emerald Network. The most threats for the habitat conservation are afforestation, encroachment of invasive species, and uncontrolled burning.

Biodiversity of the chalk grasslands of Eastern Ukraine and the problems of its conservation

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In Eastern Ukraine, chalk outcrops are mainly located in the basin of the Siverskyi Donets River on the right sloping riverbanks and associated gullies. Chalk grasslands are protected in one nature reserve, two national parks, two regional landscape parks and 46 preserves of local importance.

The only list of the vascular plants of the chalk outcrops of the Siverskyi Donets basin dates back to 1971. Of the 331 species, 10% are obligate and 4% are facultative chalk land specialists. Two relic floristic types neighbour here: the northern "lower alpine plants" (*Androsace koso-poljanskii*) and the southern "Hyssop flora" (*Thymus cretaceus*, *Hyssopus cretaceus*).

For the list updating, we choose three model sites in three administrative regions: Nature Reserve "Kreidova Flora", National Park "Dvorichanskyi", and local reserve "Kreidiani Vidslonennia". They host 58 obligate and facultative chalk associated plants. Their flora includes 14 endemics of the Siverskyi Donets and Don basins, 22 wider endemics (including Volga basin), 26 species listed in the Red Data Book of Ukraine, and three species listed in the Appendix I of the Bern Convention.

Chalk associated biota is highly dependent on the substrate structure and humus accumulation. Specialist species prefer four habitats: bare chalk of large monolithic blocks with rare deep cracks; chalky crumb; loose chalk with the initial patched organic matter; and alluvial chalk cones at the footslopes. These habitats are extremely disturbance-sensitive and require long-term monitoring.

There are no chalk grassland specialists among spiders, but 36 out of 134 species registered in the area in question have south- or southeastern origin. They spread to the north along the chalky and south facing gully slopes enriching regional faunas. Insect fauna is best studied in the Dvorichanskyi Park (680 species, 13 are endangered and two are endemics of the Central Russian Upland).

Prior to 1990s, Ukrainian chalk grasslands were overgrazed. Now they are facing another threat – encroachment of trees, shrubs and sod grasses due to the lack of disturbance. The "Kreidova Flora" is the most endangered. The natural seed bank of *Pinus sylvestris* var. *cretacea* encourages pine expansion on the chalky slopes. Everywhere, invasive *Ulmus pumila*, *Acer negundo* and *Cerasus mahaleb* worsen the situation, and even periodical fires do not prevent this process. A general strategic plan of the chalk grassland conservation in Ukraine is badly needed. It should include a pool of specific measures (cutting, racking, grazing or burning) developed for each protected site.

Testing of different grassland restoration approaches in LIFE GRASSSERVICE project

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Grassland ecosystems hold an important part of Europe's biodiversity, but these are one of threatened ecosystems all over the Europe. Grasslands offer ideal conditions for a vast diversity of species and are especially important for birds and invertebrates, providing vital breeding grounds. Grasslands are also the source of a wide range of public goods and services, ranging from meat and dairy products to recreational and tourism opportunities. The marginalization of agricultural land is one of main reasons for decline of semi-natural grasslands, although these regions are the most important for conservation of EU grassland habitats in Latvia. LIFE GRASSSERVICE project restoring 125 ha of grasslands in two municipalities – Sigulda and Ludza –, half of them are semi-natural grasslands with low grassland habitat quality. The aim of grassland restoration is to increase their biological value and ensure good preconditions for agricultural use.

Monitoring actions such as vegetation survey and soil analysis was done before grassland restoration actions to evaluate baseline conditions of habitats. The main action of restoration was removal of trees and shrubs. Roots and stumps were grubbed and larger parts of them were removed in order to not to increase level of nutrients in grasslands. In one area prescribed burning also was used to reduce level of nutrients for restoration of 6120* Xeric sand calcareous grassland and 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates grassland habitats. Rugged microrelief were smoothed out with disking, tilling and rolling. In order to improve the botanical quality of the grassland, addition species rich material sowing was used in cultivated grassland areas, but green and dry hay spreading was used in areas where grasslands have higher potential to achieve a status of European Union protected habitats.

Our results demonstrate how different grassland restoration practises affects vegetation regeneration after restoration works. The first results showing differences of vegetation regeneration between areas where soil was grubbed or disked. The grubbing of roots is effective restoration method to reduce distribution of *Solidago canadensis*, *Rubus caesius*, *Rosa rugosa* and *Rubus idaeus*. After prescribed burning in early spring and soil leveling, vegetation is regenerating with several semi-natural indicator species – *Primula veris*, *Fragaria viridis*, *Agrimonia eupatoria*, etc. Grassland restoration is quite difficult and time consuming, therefore the maintenance of still existing species-rich grasslands is very important. Success of restoration works will be monitored and evaluated five years.

Diversity, distribution and future prospects of EU natural and semi-natural grassland formations in Lithuania

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Lithuania is one of a few Member States of the European Union, which has conducted the overall inventory of the habitat types of community interest. The GIS database was compiled on the distribution, area, structure, species list, threats, etc. for each of 53 habitat types (a total of more than 85 thous. polygons that cover 4349 km² area). A total number of natural and semi-natural grassland formation (nine habitat types) polygons is 21 138, all polygons cover 756 km². The total area for each habitat type is: 6120* Xeric sand calcareous grasslands – 160 ha area; 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) – 2751 ha; 6230* Species-rich *Nardus* grasslands – 216 ha; 6270* Fennoscandian lowland species-rich dry to mesic grasslands – 22499 ha; 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) – 616 ha; 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels – 1754.55 ha; 6450 Northern boreal alluvial meadow – 14791 ha; 6510 Lowland hay meadows – 31900 ha; 6530* Fennoscandian wooded meadows – 908 ha. Average cover of the area for each polygon varies from 0.67 to 5.71 ha. The three most common habitat types (6510, 6270, 6450) together take over 91.52% of the total EU grassland habitat type area.

The grassland distribution through the country is related to human activities and region's geographical features. Habitat types 6210, 6430 and 6450 are closely related to river valleys – 6210 occur on steep, south facing slopes, 6430 – are wide spread on the fringe near water streams, 6450 – take place on low-level floodplain inundated in spring flood time. The habitat 6230 is more common in the western and southeastern parts of Lithuania, where decalcified soils prevail. The habitats 6270* and 6510 generally depend on human agricultural activities, the largest concentration of these habitat types are found in the western part of Lithuania and the Nemunas River delta. The habitat types 6120*, 6410 and 6530 are rare and occupy small patches.

About one third of the area of natural and semi-natural grassland formations occur within Natura 2000 site. The average portion of each habitat type area in Natura 2000 sites is 26.97% and five grassland habitat types (6210, 6120*, 6510, 6530*, 6270*) take less than average portion (9.19–22.47%).

Graduated intensity of grassland management in Lower Austria – a case study of Puchberg am Schneeberg

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In a project financed by the Lower Austrian landscape funds, management and vegetation of 17 farms in an area from 500 to 1250 m above sea level in the easternmost parts of the Alps with an average level of 0,9 LSU/ha were analysed. From the 475 ha of farmland about 44% are used intensively and belong to the *Lolietum multiflorae* or to species-poor forms of a *Pastinaco-Arrhenatheretum*. On the other hand, about 27% are used extensively, for hay-production or as pasture, often without fertilisation. The meadows belong to the *Ranunculo bulbosi-Arrhenatheretum* or *Filipendulo vulgaris-Brometum*, the pastures to the *Festuco commutatae-Cynosuretum* or *Carlino acaulis-Brometum*. The most species-rich grasslands showed up to 50 species in a sampling plot. There are significant differences in the intensity levels among individual farms with up to 70% used extensively. Unsurprisingly, an analysis of the livestock feed harvested from the grassland showed that mainly the intensively used plots provide the quality nowadays needed for milk production. Therefore, mainly the farms with suckler cows and cow breeding have a higher portion of extensively used grassland. Nevertheless, even those farms seem to struggle in finding an economical use for extensive grasslands, which often can't be intensified for natural reasons, often just due to the great distance from the farm. Therefore mainly some species-rich pastures are on the fringe of abandonment. An economic evaluation of the farms showed that the costs of the grassland cultivation shift when the intensity is changed, but when you look at singular farms the total costs are about the same. The economical effect of graduated intensity of grassland depends on the utilization of the fodder and the equalization payments for extensively used grassland. The variable costs of the grassland cultivation are about 380 € per hectare. On the level of individual farms, the results of the project focus on an advice for an even stronger graduation in the intensity of grassland use. Feed of high quality, mainly for milking cows, can only be produced on grassland with a rather high level of intensity. The farmers are supported in their decision to choose the best plots for this purpose and find a level of intensity within the limits of sustainability. On the other hand, the remaining grassland should be managed in a strictly extensive way, in view of the limited availability of organic manure as well as for conservation aspects and options for equalization payments.

Sigma-syntaxa of the dry grassland vegetation in the Dnister River Canyon

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The Dnister River Canyon is a unique natural area with numerous geological, botanical, geomorphological, and hydrological monuments that is located in the middle stream of the Dnister River Valley. It has a length of 250 km from the delta of Zolota Lypa River to the delta of Zbruch River. The slopes of the Canyon have “three levels”. The transverse profile illustrates the upper part (the slopes of moderate ascent, which develop usually on the argillo-arenaceous Quaternary and argillous Miocenic deposits), the middle part (characterized by denudation processes and erosion of carbonate cleavages and eluvial deposits from Cretaceous to Devonian period), and the lower part (talus and deposits of different rocks). Such geomorphological inhomogeneity determines the specific features of the distribution of rare and endangered species and phytocoenoses.

In the result, we determined 5 sigma-associations based on the dry grassland communities (*Poetum versicoloris-sigmetum*, *Seslerietum heuflerianae-sigmetum*, *Botriochloetum ischaemii-sigmetum*, *Koelerio macranthae-Stipetum joannis-sigmetum*, *Inuletum ensifoliae-sigmetum*). Basing on the synphytoindication methodology (Didukh, 2011, 2012) we calculated values for the 12 key ecofactors of the determined sigma-syntaxa, which are a platform for their β -coenodiversity evaluation. Insignificant fluctuation of thermo- and cryoregime and more significant of continentality and ombroregime indicate the specific but stable microclimatic conditions within the Canyon and explain the formation of “Warm Podillya” effect. Edafic factors (acidity, salinity, content of humus, nitrogen, calcium, phosphorus, and other elements) have significant difference between petrophytous-steppe and steppe coenoses that refers to their spatial distribution in the various parts of a slope, the nature of bedding rocks, and presence or absence different soil types. The determined combination of various biotope types specifies their features depending on which we suggest appropriate protection measures.

Grasshopper and Ground Beetle Fauna in Calcareous Grasslands of Abava River Valley

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Dry calcareous grasslands have great botanical value and serve as habitat for numerous specialized invertebrate species. Grasshoppers and ground beetles each represent different insect functional groups. They both are commonly used as indicators for habitat quality and ecosystem functionality. A multitaxon approach is crucial when assessing the effects of processes in habitats. Even though the dispersal ability and level of specialization widely varies within the orders, the species diversity is endangered as the area of semi-natural grasslands declines. In this study, responses of grasshopper and ground beetle diversity on habitat quality and management are analyzed. The results show that vegetation structure has major influence on insect diversity, but the main factors that influence grasshoppers and beetles can slightly differ, highlighting the necessity of multitaxon studies. Habitat management had mixed effects on the mentioned organisms, but both grasshopper and ground beetle diversity benefited from extensive grazing. Also, grasshopper and ground beetle species composition has to be considered when assessing the importance of dry, calcareous grasslands for insect conservation, focusing on the preservation of characteristic, habitat specialist species.

Trends in permanent grassland cover in Latvia in the period from 2007 to 2016

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Permanent grasslands are one of the most important structural elements of the Latvian landscape. They support most of biodiversity characteristic to agicultural landscapes. Most of the permanent grasslands are located in typical cultural landscapes of Latvia with hillocks and mosaic landscape pattern. However, some important changes of the spatial distribution of permanent grasslands have taken place in the recent decades in Latvia.

The current research covered a variety of permanent grassland types – sown grasslands, improved grasslands, and semi-natural grasslands. The spatial data of Integrated Administration and Control System from Rural Support Service was used in research. We analysed grassland area statistics for the period from 2007 to 2016, it changes over time, and evaluated the factors influencing grassland management and conservation, including the role of the Common Agricultural Policy (CAP) intervention. The spatial analysis included the evaluation of spatial distribution of support payments applied to permanent grassland areas. We analysed the extent and spatial distribution of permanent grassland conversion in other agricultural land in recent years.

The results show that in 2016 permanent grassland accounted for 27% of the declared agricultural areas. However, approximately 100 000 ha of agricultural land is not applied to support including significant areas of permanent grasslands. The changes of the total area of permanent grassland applied for aid are minor (1–2%) within the last years. However, spatial analysis shows significant and different trends of the permanent grassland spatial distribution depending on both the abiotic conditions and socio-economic aspects. The permanent grasslands are mainly located in regions with historically large areas of extensively managed agricultural lands. Still, new areas of permanent grassland have been created in last years in place of abandoned arable land, and in places where semi-natural grasslands have been restored for the conservation of biodiversity. The study confirms the significant role of the agricultural policy in preserving permanent grassland area. Both the direct payments and the RDP support have been important in protecting permanent grasslands from conversion to arable land or abandonment. However, in recent years, Latvia generally is characterized by increasing intensification of the agriculture sector. Therefore a small part of permanent grassland is converted to arable land. This negative trend was reinforced observed in connection with Greening implementation contrary its purposes.

Trends in the cover and spatial distribution of permanent grasslands suggest that typical cultural landscapes of Latvia are changing. They become less diverse, the mosaic pattern is becoming uniform. These changes can negatively affect the diversity and quality of ecosystem services provided by permanent grasslands.

Do rare herbs have large seeds? The seed size – distribution range trade-off hypothesis

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We tested the hypothesis that seed size is negatively related to distribution range due to the generally better dispersability of smaller seeds. In order to identify habitats where species may be at risk and need extra conservation effort to avoid local extinctions, we also studied the effects of environmental factors on the seed size and range size of species. Data for seed size, global range size and environmental factors of the habitat for 1600 species of the Pannonian Ecoregion (Central Europe) were collected from the literature. We tested the relationship between species' seed size, range size and indicator values for soil moisture, light intensity and nutrient supply. We found a negative correlation between seed size and range size; thus, a large seed – narrow range trade-off was validated based on the studied large species pool. Seed size increased with decreasing light intensity and increasing nutrient availability, but it decreased with increasing soil moisture. Range size increased with increasing soil moisture and nutrient supply, but decreased with increasing light intensity. Species typical to habitats characterised by low soil moisture and nutrient values but high light intensity values had the smallest range size. This emphasises that species of dry, infertile habitats, such as dry grasslands could be more vulnerable to habitat fragmentation or degradation than species of wet and fertile habitats. Due to the remarkably high number of species and the use of global distribution range, our study enables to support our understanding of global biogeographic processes and patterns that are essential in fine-tuning conservation priorities.

Productivity of semi-natural grasslands of Latvia

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The goal of the study was to evaluate the total grassland yields in two municipalities of Latvia with special emphases of Community importance grassland habitats. The findings were used to assess the amount of unused biomass and evaluate the biogas and bioethanol production potential in these sites.

During field works 161 aboveground biomass samples were collected from 67 randomly selected semi-natural grassland plots that correspond to 6 habitat types of Community importance (6120*, 6210, 6270*, 6410, 6450, 6510) in 2014–2016. In each site, one vegetation plot was sampled before the first cut or at the beginning of the grazing period (June/early July). In sites that were managed by late mowing, the second sample was collected in late July/August, but in unmanaged sites – the third sample was collected in September. In all cases, biomass samples were clipped at 1 cm and 10 cm above ground level within 1x1 m square. Location of the sampling plots within selected semi-natural grasslands was purely driven by a visual assessment – in the most representative place for the habitat. For each sample the total fresh and dry matter was measured and vegetation description prepared for productivity-diversity assessment afterwards. To assess the total biomass of the grasslands within the regions of interest, the field data were combined with NDVI values calculated from airborne hyperspectral and Landsat data.

The results show that the productivity varies between 1.0 t total dry matter (DM ha⁻¹) of 6120* to 4.6 t total dry matter (DM ha⁻¹) of 6510 in average (or from 0.5 to 3.8 t dry matter (DM ha⁻¹) harvested 10 cm above ground level). It also shows significant seasonal variations and vast differences among sampling years. The average yield in 2016 was up to 27% less than in 2014 and up to 30% to less than in 2015, but the total amounts of the biomass harvested in June were 18% to 30% less than those harvested few months later – in August.

The study was conducted within the framework of the EU-funded LIFE+ Nature & Biodiversity program Project "GRASSSERVICE" – Alternative use of biomass for maintenance of grassland biodiversity and ecosystem services (LIFE12 BIO/LV/001130).

Ecological theories provide strong support to grassland recovery - new frontiers in restoration

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Traditionally managed species-rich landscapes in Europe and elsewhere are facing a large-scale degradation nowadays, largely caused by changes in the intensity of agricultural land-use, such as intensification or abandonment. For the conservation of biodiversity in such agriculture-driven landscapes, dry and mesic grasslands have an outstanding importance. In the last few decades most of the grasslands were subjected to degradation, which resulted in the loss of biodiversity and other ecosystem functions and services. The recovery of grassland biodiversity by practical habitat restoration, therefore, became a top priority both in scientific research and practice. However, there is a conspicuous gap between the theory- and practice-driven approaches between biodiversity conservation science and policy highlighted in some recent studies. On one hand there are various theories and tools developed in plant ecology to understand the species assembly, dispersal and establishment processes in a wide range of habitats over the world. On the other hand, during practical grassland restoration a set of measures were used for recovering grassland vegetation and assessing restoration success during which huge amounts of evidence-based knowledge have been accumulated. A unified framework linking theoretical plant ecology with the practical implemented restoration is still lacking. We aimed to explore how theoretical findings can support a cost-effective and successful grassland restoration in agriculture-driven landscapes.

Bee assemblages of meadow habitats in the Helsinki region of southern Finland are affected by adjacent landscape structure

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Bees (Hymenoptera, Anthophila) constitute a key taxon of grassland ecosystems. From the perspective of ecosystem services, they are the main providers of the essential ecosystem service of pollination. They also play a key role in the conservation of many plant species, also through their dependence on the service of pollination. In many urban and peri-urban areas, the species assemblages of meadow habitats are changing in response to 1) qualitative changes of the habitats themselves, such as changes in management regimes, 2) landscape level changes in the environs of the sites, to which some taxa are particularly susceptible, and 3) due to changes in other taxa, either competitors or between taxa at different trophic levels. They can be divided into eusocial and solitary species; ground-nesting and cavity nesting species; and specialized (oligolectic) or generalist (polylectic) pollinators. The catch also included some kleptoparasites. In the Helsinki Meadows project, a number of taxa involved in trophic interactions in grassland ecosystems have been studied, in order to gain an understanding of the consequences for biodiversity of changes in the assemblages of different taxa. In this paper, I present the results of two years (2012 and 2013) study of bee assemblages of a set of 20 dry grassland habitats in urban and peri-urban parts of the Helsinki Metropolitan region, Finland. Bees were sampled using pan-traps of four colours (white, yellow, red and blue) and by hand-netting. The total catch comprised 721 individuals of 72 species in 2012 and 589 species of 58 species in 2013. My results show that the abundance of oligolectic and kleptoparasite species declines as the proportion of urban infrastructure and metalised surfaces increases, whereas polylectic and solitary species were less affected. The assemblages of urban areas comprise mostly common and abundant species. An NMDS ordination showed that some species from peri-urban assemblages were absent from urban areas, suggesting that a sub-set of species is unable to persist in areas affected by urbanization. Bee species with a shorter flight range were more sensitive to urbanization than those with longer flight ranges, such as bumble bees (*Bombus* spp.). Isolated meadows had lower abundance of bumble bees than sites with greater connectivity. I conclude that, in addition to appropriate site management, maintenance of vegetated open areas and meadow-like vegetation adjacent to meadows enhances bee diversity.

Mapping and identifying grassland ecosystem services and their trade-offs: study from Baltic states

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The area covered by semi-natural grasslands has considerably decreased in Europe throughout the last century as a result of land conversion to urban territories, arable land, afforestation, while remoter or/and wet areas underwent marginalization and abandonment. By mapping and identifying flow of ecosystem services and analyzing their synergies and trade-offs we aim to deliver better understanding of underlying mechanisms that could be beneficial to viable grassland management. In our study we consider a trade-off is a situation where the use of one ecosystem service directly decreases the benefits supplied by another and synergy is a situation where the use of one ecosystem service directly increases the benefits supplied by another service. By employing principal component analysis, we were able to map where trade-offs and synergies are taking place, as well to reveal underlying processes that could lead to reduction of undesirable trade-offs and enhancement of desirable synergies. Our study was conducted in Lümända county, Estonia, Cēsis municipality, Latvia, and Šilute municipality, Lithuania.

Study was financed by LIFE Viva Grass (LIFE 13 ENV/LT/000189) project.

The boundary between steppe and desert zones in the Republic of Kalmykia (syntaxonomical delimitation)

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The Republic of Kalmykia is situated within two phytogeographical zones. According to the geobotanical zoning of Soviet Union (1947), the western (steppe) part of the study area belongs to the Sagebrush-Bunchgrass strip of the Transvolga-Ural subprovince (Kazakhstan province). The eastern (desert) part of the study area belongs to the strip of Grass-Sagebrush Deserts, which belongs to the Northern-Caspian province.

The vegetation classification has been developed on the basis of own geobotanical research carried out in 2014. 60 relevés of 25 m² plot size were sampled in the study area according to the Braun-Blanquet approach. Vegetation classification was conducted using Modified TWINSPLAN and JUICE 7.0 software package.

It was found that the whole data array was divided into two main clusters, which represents respectively the desert and steppe vegetation. For the first cluster (*Artemisietea lerchianae* Golub 2004 class, *Artemisietalia lerchianae* Golub 2004, *Artemision lerchianae* Golub 2004) the diagnostic species (with fidelity index > 25%) is *Artemisia pauciflora*. Species with high level of constancy (with frequencies > 25%) are *Alyssum desertorum*, *Anisantha tectorum*, *Artemisia lerchiana*, *Artemisia pauciflora*, *Poa bulbosa*. Such communities are characterized by low species richness (5-10 species per plot) and by the total vegetation cover 40-70%.

The second cluster represents the steppe vegetation of *Festuco-Brometea* Braun-Blanquet & Tüxen ex Soó 1947 (*Tanacetum achilleifolii-Stipetalia lessingiana* Lysenko et Mucina 2016, *Agropyron pectinatae* Uzhmetskaya et Golub ex Golub et al. 2016). Diagnostic species are *Artemisia austriaca*, *Festuca valesiaca*, *Tanacetum achilleifolium*. Constant species: *Alyssum desertorum*, *Artemisia austriaca*, *Artemisia lerchiana*, *Festuca valesiaca*, *Galatella villosa*, *Kochia prostrata*, *Koeleria cristata*, *Leymus ramosus*, *Stipa lessingiana*, *Stipa sareptana*. Communities are characterized by higher floristic richness (13-29 species per relevé) and total vegetation cover (60-80%).

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Welcome to Daugavpils District in Latvia – to explore our meadows, forests, lakes and rivers! You can go by bike or to rent a boat or raft to travel in Daugavas loki/Augšdaugava, and to have a rest in cosy guest house with sauna. There are numerous opportunities of leisure, sports, sightseeing, visiting culture, historical and nature objects.