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PALAEARCTIC GRASSLANDS

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Palaearctic Grasslands

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Palaearctic Grasslands, formerly published under the names *Bulletin of the European Dry Grassland Group* (Issues 1-26) and *Bulletin of the Eurasian Dry Grassland Group* (Issues 27-36) is the journal of the Eurasian Dry Grassland Group (EDGG). It usually appears in four issues per year. *Palaearctic Grasslands* publishes news and announcements of EDGG, its projects, related organisations and its members. At the same time it serves as outlet for scientific articles and photo contributions.

Palaearctic Grasslands is sent to all EDGG members and, together with all previous issues, it is also freely available at http://edgg.org/publications/bulletin.

Scientific articles (Research Articles, Reviews, Forum Articles, Scientific Reports) should be submitted to Jürgen Dengler (juergen.dengler@uni-bayreuth.de), following the Author Guidelines published in *Palaearctic Grasslands* 37, 6–8. They are subject to editorial review, with one member of the Editorial Board serving as Scientific Editor and deciding about acceptance, necessary revisions or rejection.

All other text contributions (News, Announcements, Short Contributions, Book Reviews,…) should be submitted to Anna Kuzemko (anyameadow.ak@gmail.com) AND Idoia Biurrun (idoia.biurrun@ehu.es). Please check a current issue of *Palaearctic Grasslands* for the format and style. Deadline for submission to the next issue is **15 January 2020**

Photo and art contributions (for general illustrative purposes with captions; proposals for Photo Stories; contributions to Photo and Art Competition) should be submitted to Photo Editor Rocco Labadessa (rocco.labadessa@gmail.com). Deadline for submissions to the next Photo Competition on "Grasses and grasslands" is **15 January 2020**.

Contributions to the sections **"Recent Publications of our Members"** and **"Forthcoming Events"** should be sent to Iwona Dembicz (i.dembicz@gmail.com).

Photos included in submissions have always to be delivered in two forms, embedded in the document and as separate jpg (or tiff) files with sufficient resolution for printing (i.e. not less than 1 MB).

Palaearctic Grasslands is published by EDGG c/o Prof. Dr. Jürgen Dengler, Plant Ecology, BayCEER, University of Bayreuth, Universitätsstr. 30, 85447 Bayreuth, Germany.

Editorial Board

On front cover page: Alpine marmot (*Marmota marmota*) watching out in front of its burrow after an early snowfall in autumn, Upper Engadine, Switzerland. Photo: J. Dengler.

Editorial

Dear readers,

These days, when December is unusually mild outside, I do not exclude the possibility that for some of you the field season is still continuing, but for most it is already over. However, this is not a reason to sleep in a warm hole, as the cute animal depicted on the cover of this issue. This is the time for managing field data - samplings, collections, photographs. Moreover, this is a very good time to take stock of the outgoing year and make plans for next year.

2019 was full of events for EDGG. One such event was the Eurasian Grassland Conference (EGC), organized jointly by our members from Austria and Slovenia. In this issue, on pp. 16–25, you will find a report of the conference with many photos, as well as the impressions of some of the participants. For those who participated in the EGC, this is an opportunity to recall the wonderful atmosphere that prevailed during the conference, and for those who could not attend, the report can be an advert, and maybe an incentive to participate in future EGCs.

If you are making plans for your next season of fieldwork, do not overlook the second call of our second annual event, the EDGG Field Workshop, which will be held in southern Ukraine, and the aim of which is to collect steppe vegetation data along climatic gradients (pp. 6–15). The boundless fields of feather grass – the plant in our logo – in the illustrations for this call will say more than any words for true lovers of steppes, about the attractiveness of the sites that participants will visit during the Field Workshop.

The main result of the previous research expeditions and field workshops are high-quality data, which are stored in the GrassPlot database. The "Scientific report", on pages 26–47, presents the progress that has been made in the content and functionality of this database, which currently includes more than 190,000 high-quality grassland plots.

Christmas or the New Year are good times to give presents. If you have the desire and possibility to support our group and its activities financially, you will find detailed information on how to do this on page 4.

We hope that during these festive winter days you will find time to read the new issue of our journal. Thank you for being with us during the past year and we hope to meet with many of you in the year to come!

Anna Kuzemko, *Chief Editor*
anyameadow.ak@gmail.com

***Echinops siculus*, Puglia, Italy. Photo: R. Labadessa.**

News

Charitable Donations

Dear members of the EDGG,

With this year approaching its end, we would like to thank all EDGG members who actively contributed to the Eurasian Grassland Conference, our Field Workshops, our journal *Palaearctic Grasslands*, our website, special features, book chapters and databases in 2019 and made them a big success.

As you know, EDGG is a non-for-profit organization and since its establishment in 2008 it has offered a wide variety of services to the community of grassland ecologists and conservationists without charging any membership fees. This has been made possible through the enthusiasm of many of our members and some financial support from our mother organization, IAVS. However, we realise more and more often that we are short of money to support our wide range of activities. In particular we would like to allow more scientists with limited or no financial resources to participate in our annual conferences and field workshops, and provide linguistic editing for articles prepared by non-native speakers in our publications.

As in the previous year, we have decided to ask for your support in form of CHARITABLE DONATIONS of money to EDGG. Those of you who would like to provide some voluntary financial contributions are cordially invited to make use of this opportunity.

We appreciate any contribution be it small or large!

HOW TO CONTRIBUTE?

Please make your transfer to the following account:

Account holder: **IAVS**

Bank: **SNS Bank**

IBAN: **NL40 SNSB 0921 5290 23**

Swift for the bank: ***SNSBNL2AXXX***

Address:

Head Office, Utrechtsestraat 46 6800 Hw Arnhem, All Dutch Offices, Netherlands

IAVS Business Office, 9650 Rockville Pike, Bethesda, MD 20814 USA

Currency: **EUR**

Please include the following text: **Donation to IAVS working group EDGG**

To keep track of the donations, please additionally send a short e-mail to our treasurer, Péter Török (molinia@gmail.com), indicating when you transferred what amount of money to our account. If you wish, you can also indicate in your mail to Péter that your donation is used for one of the following main purposes:

Golden eagle (*Aquila chrysaetos*) circling above steppic grasslands in the canton of Valais, Switzerland. Photo: J. Dengler.

1 – Travel grants for the Eurasian Grassland Conferences

2 – Travel grants for the EDGG Field Workshops

3 – Linguistic editing for articles by non-native speakers in our publications

If you do not make such an indication, the Executive Committee will spend the money, where it is most needed. We intend to acknowledge those members who support our work financially in the next issue of *Palaearctic Grasslands*. However, if you prefer to remain anonymous, please inform Péter.

Many thanks for your continued support to EDGG, be it ideally, actively or financially.

We wish you calm and pleasant days at the end of the year and a Happy New Year,

The EDGG Executive Committee

(Alla Aleksanyan, Didem Ambarli, Idoia Biurrun, Iwona Dembicz, Jürgen Dengler, Anna Kuzemko, Péter Török, Stephen Venn)

Photo Story and Photo Competition

The call for the current **Photo Competition** is dedicated to the theme "**Grasses and grasslands"**, looking for photographs that best highlight the beauty of grasses (*Poaceae*), either depicting the neglected beauty of grass details or underlining their exceptional importance in grassland structure.

You are invited to send up to three high-quality photographs within the competition theme (full size JPEG or TIFF images, at least 300 dpi) together with captions giving information on the subject (species name, date, place name) and, possibly, technical details (camera, lens, aperture and exposure time).

The selection will be made by a jury of at least five members from the Editorial Board of the journal. The three best shots will be awarded with full space in the next issue, but we reserve the right to use further submitted materials for illustrative purposes in other parts of the issue.

If you feel you can contribute with your shots, don't be shy! Everyone can join the competition!

Contributions for the **Photo Story** section are always welcome. Photo Story is an open space where members can submit their own photo collection on a certain grassland-related topic of their choice. High-quality photos should be provided together with their captions (at least species names or landscape description), a brief text and possibly other graphical elements (like a map or a drawing). The selection of photos should fit for 1-4 pages and the proponents should already propose a preliminary layout (in PDF or MS Word format), which will be finally typeset by Editors. As an example, you may take a look at the Photo Stories published in previous PG issues.

If you want to contribute to these sections, or if you simply want to help us enriching the aspect of the journal, please submit your photos together with required information to Rocco (rocco.labadessa@gmail.com).

Deadline for photo submissions is **15 January 2020**!

***Rocco Labadessa*, Bari, Italy**

rocco.labadessa@gmail.com

***Briza media* at Carpathian meadow, National Nature Park "Hutsulshchyna", Ukraine. Photo: A. Kuzemko.**

EDGG Event

DOI: 10.21570/EDGG.PG.44.6-15

14th EDGG Field Workshop: Ukrainian steppes along climatic gradients

Ukraine, 25 May – 3 June 2020

Second Call

Background

The history of EDGG Field Workshops began in 2009 in Romania (Dengler et al. 2009). Before 2014 these events were called "EDGG Research Expeditions". Up to now, 13 Field Workshops have been organized: Romania (2009), Ukraine (2010), Bulgaria (2011), Italy (Sicily) (2012), Greece (2012), Russia (2013), Spain (2014), Poland (2015), Serbia (2016), Italy (Central Apennines) (2017), Austria (2018), Switzerland (2019) and Armenia (2019).

The aim of Field Workshops is to sample different taxa groups in grasslands (mainly vascular plants, mosses and lichens) across multiple scales (from 0.0001 to 100 m^2) using a standardized methodology (Dengler et al. 2016). Some animal taxa have also been sampled in several expeditions together with vegetation data, for example spiders (Polchaninova et al. 2018), leafhoppers (Filibeck et al. 2018), and butterflies (Magnes et al. 2018). The results obtained from the analyses of high-quality data from several expeditions have been already published: Romania (Dengler et al. 2012; Turtureanu et al. 2014), Bulgaria (Pedashenko et al. 2013), Ukraine (Kuzemko et al. 2014, 2016) and Russia (Polyakova et al. 2016).

These expeditions served as the basis for the creation of the "GrassPlot" Database which focuses on precisely delimited plots of eight standard grain sizes (0.0001; 0.001; ... 1,000 m^2) and on nested-plot series with at least four different grain sizes (Dengler et al. 2018). In total, the database now comprises a total of 190,673 plots, with 4,654 nested-plot series including at least four grain sizes (Biurrun et al. 2019).

Applications

All EDGG members are welcome to apply to participate in EDGG Field Workshop via the website www.edgg.org/ after **7th January 2020**. Deadline for applications is **15th February 2020**. Confirmation of participation and feedback on travel grant applications will be given not later than 1 March 2020.

All applicants except those who already participated in four or more Field Workshops have to **submit a motivation letter** (200 words maximum), explaining why they are interested in participation and what they would contribute its success during and after the Field Workshop. High priority will be given to applicants who are willing to carry out the soil analyses afterwards. Experts of non-plant taxa, such as grasshoppers, leafhoppers, spiders, butterflies, fungi or soil metagenomics are also welcome to join if they are able and willing to carry out their sampling in a way that allows joint analyses with the vegetation diversity data. Such applicants are requested to discuss a potential sampling design prior to application with Iwona Dembicz and Idoia Biurrun and to clarify with the local organizer whether there are any legal constraints. The motivation letter is the most important criterion if there are more applications for participation than places or for travel grants than money available.

Travel grants

Travel grants are provided by our parent organization IAVS, and they are only available to members of IAVS in 2020. Priority for travel grants will be given to the following groups of persons: a) students and other applicants from low-income countries; b) well-established and very active participants of previous Field Workshops; c) persons that have already agreed to organize a Field Workshop in the coming years or provide any additional input such as soil analyses or sampling and identification of taxonomic groups other than vascular plants. The final decision will depend on the combination of these three variables. The amount of money provided to a particular grantee is not a fixed sum, but depends on the available money, the demonstrated need of the respective person and his/her relevance to the success of the Field Workshop. Accordingly travel grants can cover parts of the registration fee, the full registration fee or possibly even the travel costs to get to the event.

IAVS and EDGG requires their grantees to be actively involved in the EDGG event and contribute to its success. In case of FW, it is necessary that all participants work intensively during and after the FW to obtain high-quality scientific results. Some of the tasks shared by participants are data entry and digitizing data, sorting and analyzing soil samples, preparing and identification of plant specimens. Post-FW tasks usually require a few days of work for each participant. Participants will be invited as a co-author to one or more publications using these data. It is required that IAVS grantees accept to fulfill tasks relevant to their exper-

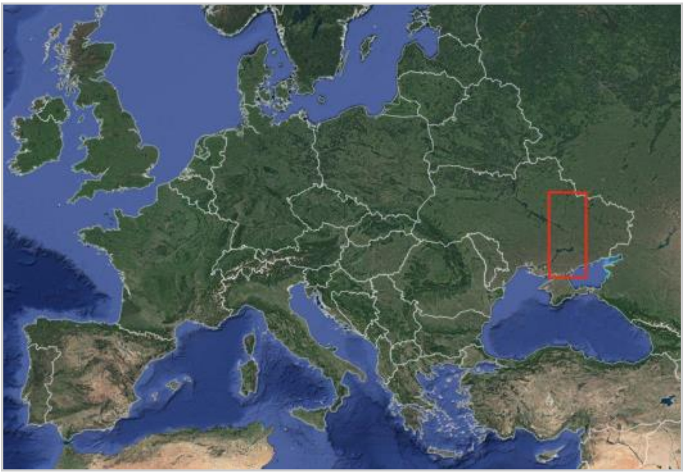

Fig. 1. Location of the study area (red rectangle) in the European context. Map data ©2019 Google, ORION-ME.

tise and capabilities during and after the FW. If a grantee does not fulfill the post-FW task, he or she may be exempted from next year's grants for EDGG events.

Fees

The fees comprise all costs of meals, travel and accommodation starting on 25 May in Kherson and ending on 03 June in Kyiv (Boryspil airport), with the possibility to return to Kherson.

The fees for **full participation** are:

- 650 € for postdocs, senior scientists or other regularly employed persons who are not IAVS members
- 600 € for postdocs, senior scientists or other regularly employed persons who are IAVS members
- 600 € for students (including PhD students) and unemployed persons who are not IAVS members
- 550 € for students (including PhD students) and unemployed persons who are IAVS members

After decision on the final list of participants and on travel grants, each participant will receive an invoice with the amount of money to be paid. **Payment** has to be made in cash on the first day of participation.

For **cancellations**, we charge the following fees:

- Until 10 April: 50% of your regular fees
- After 10 April: 80% of your regular fees

Topic and aims of the Field Workshop

The 14th EDGG Field Workshop will be held in Ukraine for the second time. The first was ten years ago, in 2010, in Central Podolia, Vinnytsia region (Dengler et al. 2010). During that expedition, 21 nested-plot series (0.0001 to 100 m²) and 184 normal plots (10 m²) were sampled, covering the full variety of dry grasslands, mainly meadow steppes and rocky grasslands (Kuzemko et al. 2014).

The new expedition will take place in Southern and Central Ukraine (Fig. 1). We will work in Kherson, Zaporizhzhia, Dnipro, Kharkiv and Poltava administrative regions. The main aim will be to investigate plant richness patterns of steppe grasslands along climatic gradients (precipitation and temperature) from the driest semi-desert communities in the south to the meadow steppes in the north.

The study area

The research area is flat and lies within the East European Plain (Fig. 1). The southern part belongs to the Black Sea Lowland, the northern part - to the Dnipro Lowland (Poltava plain). The central part of the study area is divided by the Dnipro River into two parts, one lies on the left bank of the river (Dnipro Lowland), the other steep right bank belongs to the Dnipro Upland.

The Dnipro glacier, which covered almost the entire surface of the northern part of the expedition route in the forest-steppe zone, was extremely important for the formation of the modern relief. Therefore, the plateau is cut not only by contemporary river valleys, but also by numerous ancient valleys and gullies because of the glacier melting. All the research area is covered by loess and loess-like deposits 20-25 m depth, sometimes exposed. These sediments form the Ukrainian loess belt, which is one of the biggest loess formations in the world (Muhs 2007). In the central part within the Dnipro Upland, the surface of the Precambrian foundation lies above sea level and forms granitic outcrops.

The climate is continental. It corresponds to three types according to Köppen climate classification (Beck et al. 2018): BSk – Arid, steppe, cold; Dfa – Cold, no dry season, hot summer; Dfb – Cold, no dry season, warm summer. On the southernmost area mean annual temperature is 10.3°C and mean annual precipitation is 399 mm. While in the northernmost part of the research area they are 8.9°C and 591 mm respectively (Fig. 2). On Fig. 3 we represent Walter and Lieth climatic diagrams built using “climatol” R package (Guijarro 2019) and Worldclim Version 2.0 (Fick & Hijmans 2017) for some of the localities for the expedition.

Soil types above the loess vary depending on climate and vegetation type. The main soils are chernozems with different humus content and different soil depths. Other soil types also occur - kastanozems, podzols, alfisols and others. Sometimes chernozem is influenced by salinity and replaced by solonetz and solonchak varieties. According to the physiographic zonation of Ukraine (Popov et al. 1968), the soils are dark and typical kastanozems (chestnut soils) of 40-50 cm depth and 2.5-4% humus content on the southernmost part of the expedition route. Moving to the north they are replaced by southern saline chernozems (45-50 cm depth, 4% humus content), afterwards by southern low-humus chernozems (60-70 cm, 5%), common low-humus chernozems (60-65 cm, 5.5-6%), and common chernozems (70-100 cm, 6.8-7.2%), and finally by deep chernozems (115-130 cm, 6-8%) in the northernmost steppe part. Podzols and alfisols are also present under the forests in the forest-steppe zone.

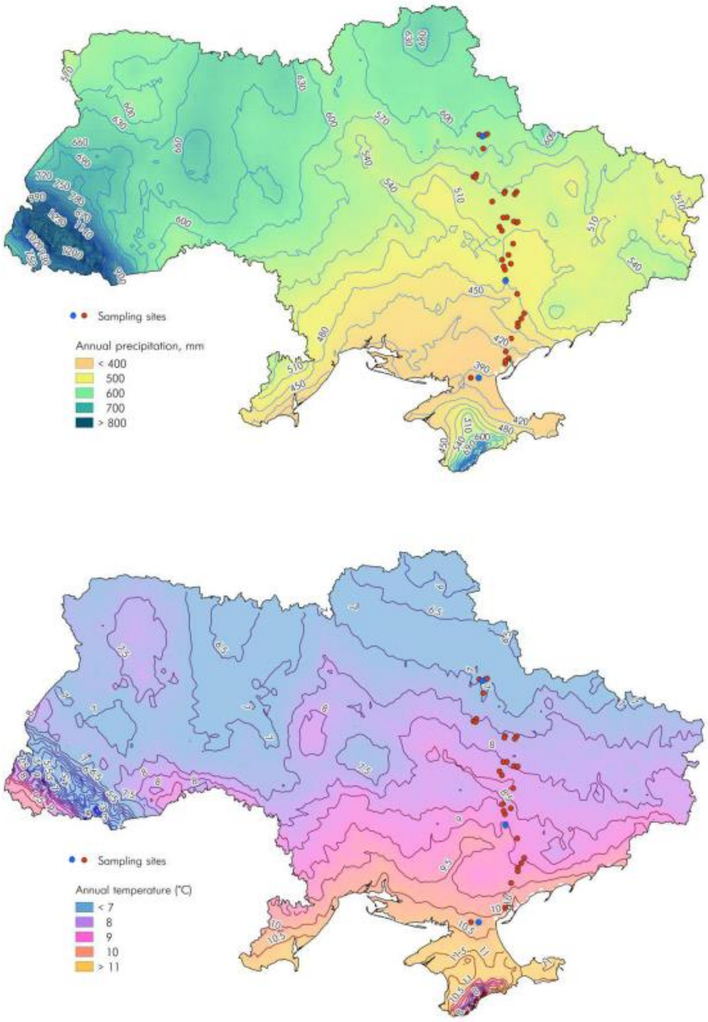

Fig. 2. Maps of Ukraine with approximate sampling locations with contour lines of annual precipitation (on the top) and mean annual temperature (at the bottom). Blue dots represent localities shown on Fig. 3.

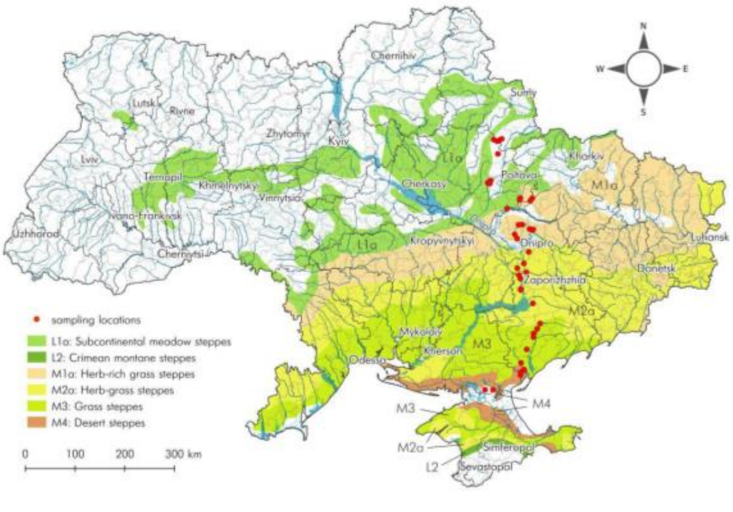

Fig. 4. Map of Ukraine with approximate sampling locations. Vegetation types based on the potential natural vegetation map of Europe (Bohn et al. 2000).

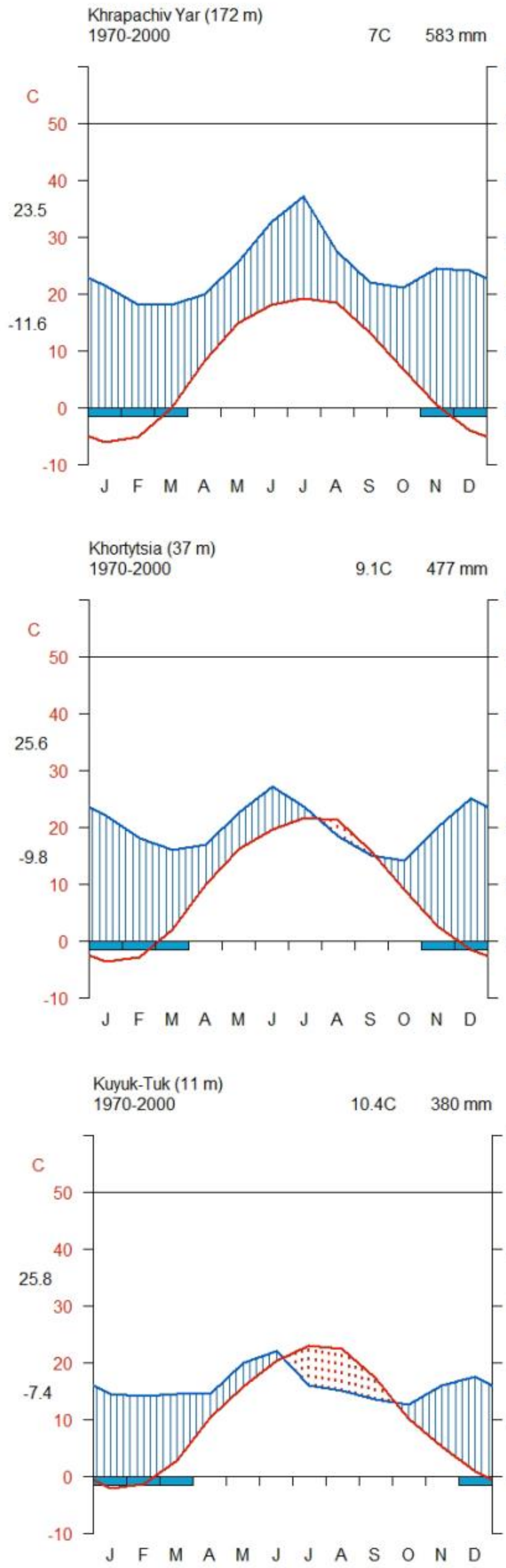

Fig. 3. Walter and Lieth climate diagrams on some localities of the expedition. A: Khrapachiv Yar village, ending point (N 50.260, E 34.499); B: Khortytsia Island, mid-workshop point (N 47.810, E 35.099); C: Kuyuk-Tuk Island, starting point (N 46.072, E 34.407).

Flora and vegetation

Several physiognomic classification systems arrange steppe types along climatic (latitudinal) gradients and therefore each steppe type corresponds to a zonal vegetation type (Hurka et al. 2019). In Ukraine, the most common way to determine steppe types is based on the dominant approach, which is based on the main dominant species of communities – "edificators". Higher units traditionally include the following climatic steppe types: desertified steppes, bunchgrass steppes, forb-bunchgrass steppes and meadow steppes (Bilyk et al. 1973). Another similar classification system of zonal steppe types was used in the Map of the Natural Vegetation of Europe (Bohn et al. 2000), according to which the following steppe types are recognized in Ukraine along an increasing precipitation gradient from south to north: desert steppes, grass steppes, herb-grass steppes, herb-rich grass steppes, Crimean montane steppes, subcontinental meadow steppes (Fig. 4).

The classification of vegetation based on complete species lists has not been commonly applied in Ukraine, but it is currently being developed. It still needs clarification and large-scale comparison to distinguish the most suitable units. Desertified salt steppes are classified within the alliance *Artemisio tauricae-Festucion* described from Crimea. Dominants of such communities are *Festuca valesiaca*, *Agropyron cristatum* and *Artemisia taurica* (Kolomiychuk & Vynokurov 2016). We will sample them during the first day in the Sivash Lake region within the Azovo-Syvashskyi National Nature Park (Churiuk and Kuyuk-Tuk Islands) (Figs. 5, 6, 7).

For the bunchgrass steppes, the alliance *Tanaceto millefolii-Galatellion villosae* was proposed (Kolomiychuk & Vynokurov 2016). This unit combines communities with *Agropyron cristatum, Astragalus ponticus* (Fig. 8)*, Bassia prostrata, Ephedra distachya, Goniolimon tataricum, Stipa ucrainica, Tanacetum millefolium* and *Vincetoxicum maeoticum* (Fig. 9), which do not occur or only rarely in more humid climates. This type of vegetation will be sampled during the 2nd and 3rd day of the Field Workshop on the slopes of Syvashyk Liman, Utliutsky Liman, Velykyi Utliuk, Tashhenak and Molochna River Valleys, Troitska Balka. These sites preserve many endangered steppe species such as *Allium regelianum, A. pervestitum, Astragalus reduncus, A. pallescens, Caragana scythica, Cymbochasma borysthenica, Rhaponticoides taliewii, Tulipa gesneriana* (Kostyliov et al. 1994; Kolomiychuk et al. 2012).

More to the north, bunchgrass steppes are replaced by forb-bunchgrass true steppe communities, which are classified within the alliance *Stipo lessingianae-Salvion nutantis*. These communities are characterized by such species as *Astragalus austriacus, Bellevalia speciosa* (Fig. 10)*, Euphorbia nicaeensis* subsp. *stepposa, Galatella villosa, Jurinea arachnoidea, Nepeta ucranica* subsp. *parviflora, Phlomis herba-venti* subsp. *pungens* (Fig. 11)*, Teucrium polium,* and *Viola ambigua*. We will sample these communities during the following five days in Zaporizhzhia, Dnipro, Poltava and Kharkiv regions. Natural vegetation can be found in the river valley systems (Dnipro, Samara, Kil'chen: Fig. 12, Oril River Valleys).

In the forest-steppe zone true steppe vegetation is replaced by meadow steppes which can be classified within the alliances *Festucion valesiacae* or *Cirsio-Brachypodion pinnati*. These communities are dominated by grasses (*Elytrigia intermedia, Festuca stricta* subsp. *sulcata, Stipa capillata, S. pennata, S. tirsa,*) and forbs (*Filipendula vulgaris, Salvia pratensis, Trifolium montanum,* etc.). We will sample these vegetation type during the 6th and 9th days of the expedition, in the vicinity of Poltava and Zin'kiv.

Fig. 13 shows the diversity of steppe types we will sample during the Field Workshop.

Fig. 5. Syvash Lake. Photo: D. Vynokurov.

Fig. 6. Kuyuk-Tuk Island. Photo: M. Peregrym.

Fig. 7. Slopes of Churiuk Island and Syvash Lake. Photo: D. Vynokurov.

Fig. 8. *Astragalus ponticus.* Photo: D. Shyriaieva.

Fig. 10. *Bellevalia speciosa.* Photo: I. Moysiyenko.

Fig. 9. *Vincetoxicum maeoticum*. Photo: D. Vynokurov.

Fig. 11. *Phlomis herba-venti* subsp. *pungens*. Photo: V. Maniuk.

Preliminary syntaxonomical scheme of *Festuco-Brometea* class vegetation of the research area on the alliance level:

Festuco-Brometea Br.-Bl. et Tx. ex Soó 1947

- *Tanaceto achilleifolii-Stipetalia lessingianae* Lysenko & Mucina in Mucina et al. 2016
  - *Artemisio tauricae-Festucion* Korzhenevsky & Klyukin 1991
  - *Tanaceto millefolii-Galatellion villosae* Vynokurov in Kolomiychuk & Vynokurov 2016
- *Festucetalia valesiacae* Soó 1947
  - *Stipo lessingianae-Salvion nutantis* Vynokurov 2014
  - *Festucion valesiacae* Klika 1931
- *Brachypodietalia pinnati* Korneck 1974
  - *Cirsio-Brachypodion pinnati* Hadač et Klika in Klika et Hadač 1944d

Preliminary itinerary of the Field Workshop

Our itinerary is shown in Table 1. We will stay in four different accommodations along our travel from Kherson to Kyiv.

Our sampling sites include the Azovo-Syvashskyi National Nature Park, Pryazovskyi National Nature Park, Regional Landscape Park “Dniprovi Porohy” (Fig. 14) and other locally protected areas. Other dry grasslands are parts of designed natural parks or local nature reserves. Some territories are also protected as sites of the Emerald Network in Ukraine.

Important Travel Information

Starting point for the Field Workshop is the main train station in Kherson, where we will collect participants. There are two options for getting to Kherson city: (1) flight to Kyiv and then have a night train from Kyiv to Kherson, or (2) flight to Kherson. There are two international airports in Kyiv - Boryspil International Airport (KPB) and Kyiv International Airport (Zhuliany) (IEV). These are connected with all the main European airports. Kherson International Airport (KHE) is connected with Kyiv, Istanbul, Katowice, Kraków and Vienna.

Fig. 12. Kil’chen River Valley. Photo: V. Maniuk.

We intend to leave from Kherson and start Field Workshop on Monday, 25th May, at 09:00 a.m. FW will finish on Wednesday, 3rd June, at approx. 16:00, in Kyiv city (airport Boryspil) or at approx. 20:00, in Kherson city. At the end of the expedition we can leave participants at the airport as well as in the city center in both cities. Please ensure that you organize your flight journeys so that they fit with this plan. Please book accommodation yourself if you need it on the night before or after the expedition (i.e. 24/25 May in Kherson or/and 03/04 June in Kyiv/Kherson). If you do not have a suitable connection or if you need help with booking hotels, you can contact Dariia Shyriaieva (darshyr@gmail.com) for assistance. For all who plan to reach Kherson by night train from Kyiv, we recommend to contact Dariia for organized purchase of tickets.

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Fig. 13. Examples of dry grasslands in the study regions of the 14th EDGG Field Workshop. From upper left to lower right: forb-bunchgrass steppe in Abazivka (Photo: D. Davydov) and Kil'chen River Valley (Photo: V. Maniuk), bunchgrass steppes on Churiuk Island and in Troitska Balka (Photos: V. Kolomiychuk), meadow steppes in Samara River Valley (Photo: V. Maniuk), desertified salt steppes on Kuyuk-Tuk Island (Photo: D. Vynokurov).

Table 1. Preliminary itinerary of the 14th EDGG Field Workshop in Ukrainian steppes along climatic gradients.

Day	Times (approx.)	Journey	Dry grassland sites (preliminary)	Overnight
25 May (Monday)	09.00	Kherson - Syvash Lake - Henichesk	Morning: Meeting the group near the main train station (Kherson)	Henichesk
	19.00		Afternoon: Churiuk Island and Kuyuk-Tuk Island	
26 May (Tuesday)	08.00	Henichesk - Syvashyk Liman - Henichesk	Morning: Syvashyk Liman	Henichesk
	18.00		Afternoon: Utliutsky Liman and Velykyi Utliuk River Valley	
27 May (Wednesday)	08.00	Henichesk - Melitopol - Zaporizhzhia	Morning: Tashhenak River Valley, Troitska Balka	Khortytsia Island (Zaporizhzhia)
	19.30		Afternoon: Molochna River Valley	
28 May (Thursday)	08.00	Zaporizhia - Step-nohirsk - Zaporizhzhia	Morning: steppe gulleys in Dnipro River Valley	Khortytsia Island (Zaporizhzhia)
	18.00		Afternoon: Khortytsia Island	
29 May (Friday)	08.00	Zaporizhzhia - Vidrad-ne - Dnipro	Morning: steppe gulleys in Dnipro River Valley	Dnipro
	18.30		Afternoon: regional landscape park “Dniprovi Porohy”	
30 May (Saturday)	08.00	Dnipro - Spaske - Sa-mara river - Dnipro	Morning: Kil’chen River Valley	Dnipro
	18.00		Afternoon: Samara River Valley	
31 May (Sunday)	08.00	Dnipro - Nehvoroshcha - Poltava	Morning: Kil’chen River Valley, Oril River Valley	Poltava
	19.00		Afternoon: vicinity of Poltava town	
1 June (Monday)	08.00	Poltava - Klymivka - Stepove - Poltava	Morning: Orchyk River Valley	Poltava
	18.30		Afternoon: Berestova River Valley	
2 June (Tuesday)	08.00	Poltava - Zin’kiv - Pol-tava	Morning: vicinity of Zin’kiv town	Poltava
	18.30		Afternoon: vicinity of Zin’kiv town	
3 June (Wednesday)	08.00	Poltava - Kyiv	Morning: returning to Kyiv, stop for the sam-pling in the flood plain of the Psel River	Departure
	15.30		Afternoon: arrival to Kyiv (Boryspil airport)	

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Fig. 14. Dry grasslands in "Dniprovi Porohy" Regional Landscape Park. Photo: V. Maniuk.

EDGG Event

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Post-conference report

16th Eurasian Grassland Conference (2019)

Graz, Austria and Maribor, Slovenia

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Abstract

The 16th EGC took place jointly in Austria and Slovenia between 29th May and 5th June 2019. A total of 68 participants from 17 European countries were welcomed. In hall sessions, 27 oral (10 from young investigators) and 22 poster (9 from young investigators) contributions were presented. Three keynotes, Zsolt Molnár, Matej Vidrih and Wolfgang Willner, gave inspiring and informative plenary talks. Optional workshops were held on Natura 2000 biogeographical processes, scientific writing and bryophyte identification. A mid-conference excursion was taken to a "hay-milk region" in Steiermark and a three day post-conference excursion to Slovenia.

The main topic of this year's conference was to discuss the economic value of species-rich grasslands. The aim was to connect the biological and agronomical as well as sociological aspects of the grassland preservation. The conference brought those different disciplines related to grasslands together. Participants had the opportunity to hear studies and perspectives from different sides. It was concluded that both biology and agronomy need to learn more from each other to find ways of how this treasure of 6,000 years of grassland culture can survive.

Introduction

The 16th Eurasian Grassland Conference "Species-rich grasslands in the Palaearctic – a treasure without economic value?" was held in in Graz, Austria with a post-conference excursion in Slovenia from 29th May to 5th June 2019 (Magnes 2019). The conference was organized jointly by Martin Magnes, Institute of Biology, University of Graz as well as Nataša Pipenbaher and Sonja Škornik, Department of Biology of the University of Maribor, Slovenia and was supported by the University of Graz and the Nature Park Zirbitzkogel-Grebenzen. It took place in the Botanical Garden and in the halls of the Institute of Biology, Department of Plant Sciences of the University of Graz. The event was officially opened on 30th May by the speech of the head of the Department of Plant Sciences of the University of Graz, Martin Grube.

Keynote speakers and mid-conference excursion

Three keynote speakers gave inspiring and informative plenary talks. The first one, shortly after the opening ceremony, was presented by Zsolt Molnár (Fig. 1, Traditional Ecological Knowledge Research Group at the MTA Centre for Ecological Research, Hungary) with the title "Maintenance of species-rich grasslands by traditional farmers: diversity, practice, knowledge, subsidies and future" where he showed the deep knowledge of grassland ecosystems of the local Hungarian Csángó in the Eastern Carpathians in Romania and how they could use it for devoloping sustainable management techniques. The second keynote lecture was given by Matej Vidrih (Fig. 2, Biotechnical Faculty, University of Ljubljana, Slovenia) on "Sustainable pasture management in Slovenia: balancing productivity and biodiversity" in the morning of the 31st

Fig. 1. Zsolt Molnár giving the 1st keynote lecture on the 30th of May. Photo: P. Sengl.

Fig. 2. Matej Vidrih presenting the 2nd keynote lecture on the 31th May. Photo: P. Sengl.

May. It was a perfect introduction to the mid-conference excursion, organized and guided by Martin Magnes, to Neumarkt in der Steiermark that showed us two farms that can use species rich grasslands for economic milk production. The 42 participants first visited the farm of the Sperl family in Mariahof were we saw the stable and the winter paddock following by a walk along their haymeadows and pastures. Magda Witzmann gave a short compilation of the results of her master thesis on the biodiversity of these pastures (Fig. 3). Our next and last target was the farm "Zeischgl" (Fig. 4), belonging to the Wölfl family who sells their home made products by direct marketing. After visiting the pastures, haymeadows, fields and some of the tourist facilities we were invited by the Naturpark Zirbitzkogel-Grebenzen for a tasting of the farm products.

The last keynote lecture was given by Wolfgang Willner (Fig. 5), VINCA - Vienna Institute for Nature Conservation and Analyses and University of Vienna, Department of Botany and Biodiversity Research, Austria) about "Semi-dry grasslands of Central and Eastern Europe - syntaxonomic and biogeographical aspects". In his lecture Wolfgang showed the high probability of the existence of "semi-natural grasslands" during the whole Holocene in Europe.

Workshops and hall sessions A total of 68 participants from 17 countries were welcomed (Fig. 6). During hall sessions, 27 oral and 22 poster (Fig. 7) contributions were presented. Thanks to IAVS for supporting nine presenters with travel grants. Three optional workshops were held. A pre-conference workshop on Natura 2000 was led by Theo van der Sluis and Jan Sliva, 15 participants attended. After an introduction into the Biogeograpical Process (BGP) and the EU habitat plan for European semi-natural dry grasslands (code 6120) as well as European dry heaths (code 4030) by Theo, Jan showed some current Life-supported grassland projects and best practise examples. Working in small groups, the participants discussed (Fig. 8): 1. What are the

Fig. 3. Magda Witzmann on the pastures of the Sperl-farm during the mid-conference excursion. Photo: M. Magnes.

Fig. 4. Hay meadows of the farm Zeischgl, in the background the Zirbitzkogel. Photo: M. Magnes.

Fig. 5. Wolfgang Willner giving the 3rd keynote lecture on the 1st June. Photo: M. Magnes.

values delivered by grasslands? 2. How do farmers use and manage species rich grasslands? 3. What are best practices for grassland management? 4. What are important socio-economic conditions to conserve these grasslands? After the presentation of the results, Theo moderated a discussion, that showed that a majority thinks that a somehow economical use of these grasslands would be the most important aspect for their preservation.

The second workshop, on the topic of scientific writing, was organized and led by Jürgen Dengler on the 30th May, after the poster sessions, and was attended by 10 participants. The participants learnt key points in clear and concise scientific writing.

Parallel to the already mentioned mid-conference-excursion on the 31st May, Christian Berg led a bryophyte identification field-workshop (Fig. 9) where seven participants received detailed guidelines, learnt the collecting of bryophyte specimens, key features for their identification and got familiar with common species in cities and grasslands.

Post conference excursion

The post-conference workshop of this year's EGC was organized by Sonja Škornik and Nataša Pipenbaher from the University of Maribor. The excursion took place in Slovenia between 2nd and 5th June. In addition to the organisers, Mitja Kaligarič, Igor Paušič, Branko Bakan, Matej Vidrih and Stanka Dešnik were our excursion guides. A total of 25 participants joined the excursion and observed the diversity of the Goričko Landscape Park (Fig. 10), which forms one part of the Trilateral Park extending across Austria, Hungary and Slovenia. Goričko is a well-preserved example of typical and traditional Central-European agricultural landscape with a mosaic of fields, grasslands, orchards, vineyards, hedges and forest. The next morning the participants visited the Šturmovci Landscape Park (Fig. 11), were they could marvel at semi-dry alluvial hay meadows – the traditional management left some trees to preserve the hay from being washed away by summer floods of the near Drava river.

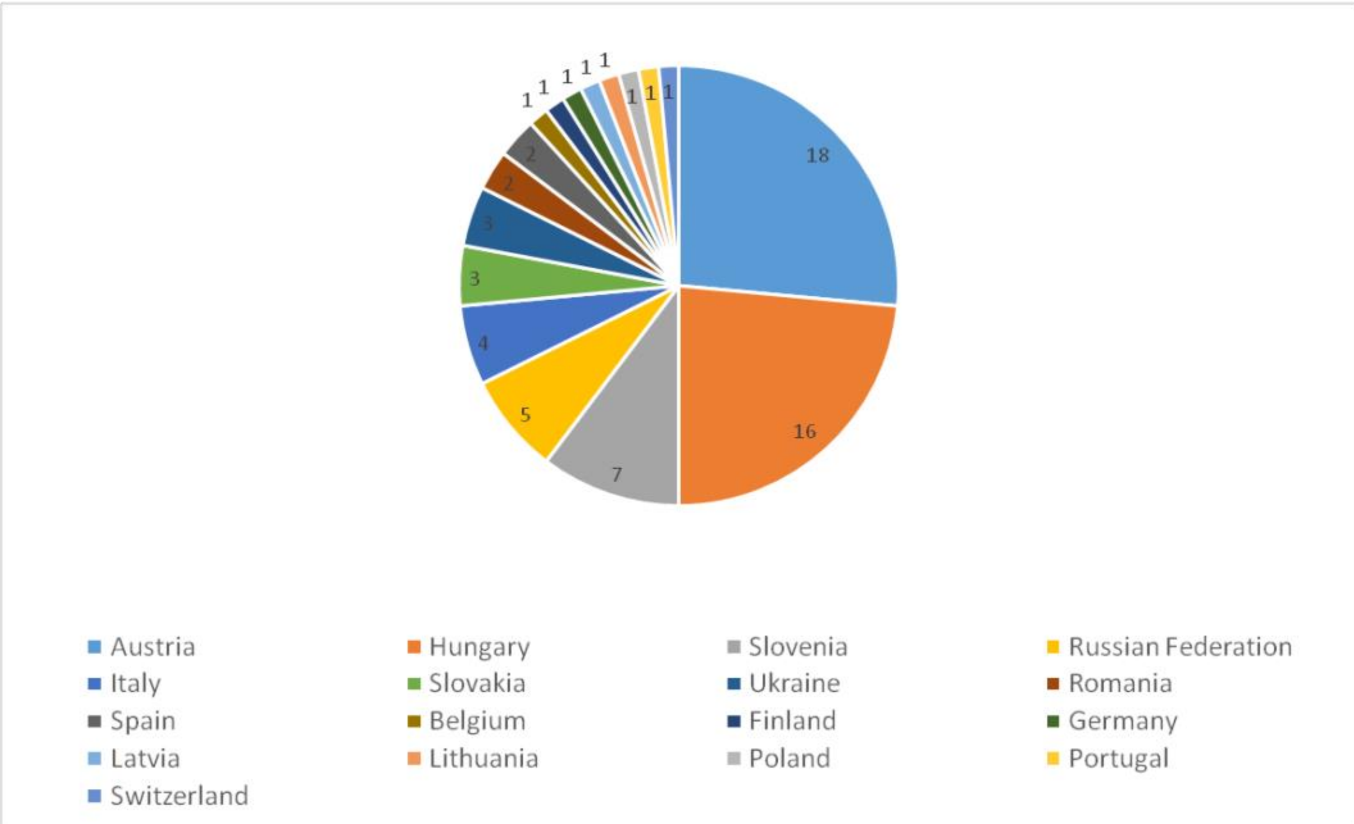

Fig. 6. Number of participants from different countries.

Fig. 7. Poster session. Photo: P. Sengl.

Fig. 8. Natura 2000 workshop, Luciana Carotenuto presenting the ideas of her group. Photo: M. Magnes.

Later they visited the Haloze region (Fig. 12), which has the highest density of "orchids-rich meadows" (*Bromion erecti*, ass. *Onobrychido viciifoliae-Brometum*) in Slovenia (approx. 25% of non-forest land), bearing fantastic orchid habitats (Fig. 13). The third day took participants to the Slovenian Northern Adriatic karst zone, which represents the northwesternmost branch of the Dinaric mountain range, extending along the Eastern Adriatic (Fig. 14).

Social events and young investigator prizes

The participants enjoyed a grassland party on the evening of the 31st May, savoured typical Styrian food, wine (including examples from the Slovenian Stajerska), a special brewed "16th EDGG conference beer" and some music performances from regional artists in the nice buildings of the green houses of the Botanical Garden. On the last day, the EDGG general assembly was held where chairs informed participants about past, current and future activities and received participants' valuable opinions. Finally, six researchers under the age of 35 received Young Investigator Prizes for outstanding talks or posters (Fig. 15). We congratulate Réka Kiss (1st prize talk), Peter Kozel (2nd prize talk), Laura Godó (3rd prize talk), Iris Moeneclaey (1st prize poster), Katalin Lukács (2nd prize poster) and Maik Preßnitz (3rd prize poster).

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We thank our keynote speakers, tutors and excursion guides for sharing their expertise with us. We also thank our student helpers for their help during the conference days.

Reference

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Fig. 9. Christian Berg explaining field determination of bryophytes. Photo: P. Sengl.

Fig. 10. First day of the post-conference excursion in the Goričko Landscape Park. Photo: N. Pipenbaher.

Fig. 11. Second day of the post-conference excursion in Šturmovci Landscape Park. Photo: N. Pipenbaher.

Fig. 12. Second day of the post-conference excursion in the Haloze region. Photo: N. Pipenbaher.

Fig. 13. *Ophrys holosericea* in the Haloze region. Photo: M. Magnes.

Fig. 14. The third day of the post-conference excursion in the Ćićarija, Mitja Kaligarič explaining details of a hay meadow. Photo: M. Magnes.

Fig. 15. The proud winners of the YI competition. Photo: J. Dengler.

Anna Komarova, Russian Federation

Dear colleagues!

I'm very grateful for the chance to participate in the 16th EDGG conference in Graz, Austria. This was my first EDGG conference, and I was really impressed by the very friendly and hearty atmosphere! At the same time the atmosphere was really productive and inspiring for very intensive work.

The topic of the conference - Species-rich grasslands in the Palaearctic – a treasure without economic value? – was rather new for me. It complements our research, because in Russia we investigate grasslands on abandoned land – the only type of place where we have *Molinia* meadow, for example. I was very pleased to present two reports covering our work. One of them, concerning two microsites, was presented first. Therefore, the questions and following discussion provided a great step forward for this research. In addition, the discussions and sessions at the conference made me realise that succession on abandoned lands (in our case) not only increases species richness, but also results in a decrease in the number of syntaxa.

I would like to say Thank you to Jürgen Dengler for the very useful Paper Writing Workshop. In spite of the very late time of the workshop, the content was very clear. My only suggestion for the conference would be to have more workshops or training sessions.

I also like the conference hosting. The botanical garden was really amazing! Honestly, I'm sure that the meditative walking through the collection redounded to advantage of assimilation and reinterpretation of the new information:) And I like Graz – the small quiet town with the aura of ancient European settlement. At the same time, the logistics were very handy and comfortable.

Of course, I really enjoyed the field trip! It's difficult to imagine seeing traditional agriculture and (semi-)natural landscapes at the same time! And – again – I appreciated the atmosphere of the field trip. Due to a lot of comments and consultation, I've learned a lot about Central Europe's flora and vegetation.

So thanks a lot to IAVS and EDGG for supporting of my participation and all conference attendees for a very productive and inspiring time! I'm sure this is not the last EDGG conference I attend, and hope to be part of a Big Grassland Community! I send the warmest wishes to all of you from cold Russia!

Vadim Prokhorov, Russian Federation

The conference in Graz was my first experience in participating in EDGG events. Prior to this, I only participated in IAVS symposia and EVS workshops. I was very happy to meet new people and see familiar faces. The venue impressed me a lot, the city of Graz is very beautiful with many big old parks and historical places. I really liked the University botanical garden where the conference was held, with a large collection of plants in greenhouses and arboretum. I would like to thank the Executive Committee of EDGG for financial support and the opportunity to participate in the 16th Eurasian Grassland Conference. The conference program was very interesting and useful for me. It was a nice place to present the part of our work dedicated to distribution modeling of different plant communities. It was possible for me to communicate with many researchers from different countries and we found common topics for discussion. All presentations from participants were very interesting for me, especially the keynote talks, which helped me gain further understanding about many areas of work and new trends in the study of grasslands by European researchers.

However, the field excursions made the greatest impression on me. In a short time, it was possible to see a huge variety of natural habitats, from high alpine meadows to the Mediterranean coast. We traveled all over Slovenia and saw how grasslands are used and protected in different places.

As a flora specialist, I was extremely interested in seeing and photographing new plant species for me in their natural environment during the excursions.

Many thanks to everyone who participated in the preparation and conduct of the conference and excursions, and for excellent communication with us before our arrival. These are professional and enthusiastic people. I am looking forward to the next EDGG events!

Maria Kozhevnikova, Russian Federation

I would like to say a great big thanks to the IAVS for supporting my participation on the 16th Eurasian Grassland Conference in Austria and Slovenia. It was a great experience for me. I have got a lot of new ideas about my future work and inspiration for it. The conference location seemed extraordinarily appealing to me. I think that the choice of such venues, which are very beautiful in nature and with a long cultural history at the same time, help to strengthen the desire to preserve all of this for future generations.

It was my first time attending an EDGG conference. I likeed the spirit at the conference very much because all participants cooperated in order to contribute to grassland conservation and restoration in the Palaearctic realm.

I want to say a big thank you to the organizers of the conference for the careful selection of key speakers; all of them were extremely interesting and professionally useful.

The post-conference tour was just awesome! It opened Slovenia to me, so small and so beautiful. I took a large number of photos in order to use them in the future to prepare lectures for students (different types of land use, unique types of communities, amazing Karst plateau). I want to thank the organizers for the great conference and I am looking forward to the next EGC and other EDGG events!

Natalia Dulepova, Russian Federation

I am very thankful to the EDGG and IAVS grant committee for the travel support and the opportunity to participate in the 16th Eurasian Grassland Conference (EGC) in Graz (Austria). The EGC 2019 was the first EDGG conference attended. I have never felt such sensitive support at a conference. There was a helpful and generally relaxed working attitude all at the same time. The selected city of Graz for the conference was ideal – a remote, comfortable, beautiful and green town. I enjoyed all presentations from keynote speakers, which gave me chance to have a broad-scale view on current international challenges and tendencies of different research in grasslands. The mid-conference excursion in the Neumarkt in Styria was very exciting and informative for me. It was fascinating to learn and to see how management, management changes and abandonment have shaped the appearance and plant species composition of these grasslands. Wolfgang Willner's lecture devoted to the semi-dry grasslands of Central and Eastern Europe was especially valuable to me. This knowledge is relevant to me, as I take part in common projects with our Siberian colleagues devoted to diversity and syntaxonomy of steppes from Ural to Trans-Baicalia. One of the most significant and very useful parts of the conference for me was the scientific writing workshop led by Jürgen Dengler. Thank you for the detailed analysis of the article, answers to the questions and recommended literature. I thank the organizers of the post-conference excursion to Slovenia. This allowed me to expand my knowledge, to see places unforgettable in beauty.

Philipp Sengl, Austria

The 16th Eurasian Grassland Conference was especially exciting for me because it took place in the region where I live (Styria, South-East Austria), introducing the participants to some of the most exciting places of Austria and – during the post-conference excursion – to Slovenia. With my colleagues I contributed to the scientific program with one poster and one oral presentation. While the poster, presented by my colleague Lisa Bernhard (University of Graz), dealt with germination properties of several dry grassland species, the oral presentation gave a preview of a new research topic: using habitat suitability models for pre-selecting most promising sites for restoration measures. The latter was presented by Patrick Schwager (University of Graz). One of the highlights for me was participating in the bryophyte course, during the mid-conference excursions. My former doctorate supervisor, Christian Berg, took us to a low to mid mountain range (640–960 m a.s.l.) in the vicinity of Graz (Semriach) und gave us some insight in the diversity of grassland bryophytes (Fig. 1). All in all, we exceeded the excursion target by far and collected more than 40 species, although we found time for a coffee and cake break too. Due to his enthusiasm in the field (Fig. 2), Christian was easily able to arouse our interest in this exciting field of botany. Traditionally, the 'grassland parties' are the main social events of the EGCs and are highly valued by the participants. Besides scientific interchange or design of common studies, it's the place to gain new friends in the scientific community. Additionally, during the grassland party in Graz a new tradition was founded – the auction of grassland-related artifacts. In my case, I was extraordinarily happy to purchase a traditional Romanian shepherd's crook (Fig. 3) made of European cornel (*Cornus mas*) which was provided by courtesy of Zsolt Molnár. Additionally, Zsolt showed me how to use it as a seat in the field… it´s more comfortable than one might expect! So, by purchasing the shepherds crook, the IAVS grant was partly reinvested to support the Eurasian Dry Grassland Group and will persistently remind me of the wonderful conference in Graz.

Fig. 1

Fig. 2

Fig. 3

Edina Tóth, Hungary

This year's 16th Eurasian Grassland Conference well-explored the issues and experiences of dry grasslands from many different perspectives. The conference was organized around four sessions, where all those interested found the most appropriate lecture and poster for their field of interest. I am grateful that I managed to get to the conference with the help of the travel grant, and after my first EGC conference in 2016 I was able to present our Hungarian study on the effects of cattle grazing, in which I tried to draw attention to the importance of grassland-type management. My presentation was given in section 2, where we were able to present our national experiences with lawns together with many Hungarian colleagues. For me, the two major presentations of the conference were Zsolt Molnár's plenary presentation and his presentation in section 3, where we could see how important it is to observe in detail the traditional lawn practice, the ancient relationship between people and nature and the acquisition of traditional knowledge that for example the local farmers of Gyimes and the shepherds of Hortobágy know and practice even today. But through several lectures, we could get an overview of the lawn and lawn management practices of the country organizing the conference, Austria. In the poster section, more than 20 posters were presented by the authors, which proved to be a good opportunity for young researchers to introduce themselves and the mood of the public performance. In my opinion, we have heard good poster presentations and interesting results have been shared.

The mid-conference excursion was also a good day and lively day during which we visited farms in Neumark / Steiermark as planned, but only two hay milk farms and surroundings: a hay milk farm of Sperl family in Mariahof and a hay milk farm: Farm Wölfl (Buschenschank Zeischgl). During the first bus stop we went to extensive grazing grasslands, which were very species rich and spectacular, with many interesting plant species such as *Persicaria bistorta, Clematis alpina, Dactylorhiza sambucina, Valeriana tripteris, Campanula* and *Primula* species. At our second stop, we were surrounded by a hay milk farm- Farm Wölfl. The farm is very old, has been a family of owners for several generations. They were engaged in the production of butter and cheese, from which we could get tasty samples at the end of the trip. The grasslands here are more heavily loaded by grazing, as they are grazing cattle in the surrounding lawns for the production of butter and milk. The mowing of mowed grasslands is the source of winter feeding for animals. In this region, this is a form of farming and livelihood. The produced dairy products are sold to local, nearby restaurants, where organic products are becoming more and more popular. During the excursion around the farm, there were also high numbers of species, such as: *Persicaria bistorta, Pimpinella major, Avenula pubescens, Geum rivale, Dactylorhiza majalis, Pinguicula vulgaris*. After the excursions, we could take part in the high-quality grassland party. All in all, we were able to listen to presentations from a number of perspectives and see the posters, and we also got an insight into the operation of the hay milk farms. The conference was also useful for me, and I have try to use the knowledge gained during the conference in our research on grasslands and cattle grazing. Thanks again for the travel grant.

Tatyana Gavrilova, Russian Federation

EDGG events allow vegetation scientists from different countries to share the results of their work as well as to get new ideas and inspiration for future research. Thus, I am very grateful to the EDGG and IAVS grant committee for the travel support and the opportunity to participate in the 16th Eurasian Grassland Conference in Graz, Austria.

This was my first EDGG conference as well as my first international conference; hence, I was particularly excited to participate in it. I was fascinated by the opportunity to meet people whose scientific articles I have read for my research. I was pleasantly surprised by the atmosphere of EGC 2019, both relaxed and professional. My aim of participating in the conference was to present the first results of studying functional traits of leaves at abandoned and managed sites in Central Forest Reserve, NW Russia, as a poster. I had a wonderful opportunity to discuss the results of my work and received valuable feedback. I hope that it will help me to improve the quality of my future research. Furthermore, participating in the conference allowed me to improve my communication skills and to learn more about current methods and approaches of studying grasslands.

I was especially interested in a workshop on scientific writing guided by Jürgen Dengler. I am particularly grateful to Jürgen and the participants of the workshop for valuable advice concerning various aspects of scientific writing such as structuring the article and its parts, choosing the best title and targeting the journal most suitable for the article.

I would like to thank local organizers of EGC 2019 for a delightful social dinner with traditional Styrian cuisine and music as well as for the mid-conference excursion to Neumarkt. It was an excellent opportunity to learn more about EU practices of grassland management and organic farming as well as to enjoy the magnificent landscapes of the Alps. Thank you all for a wonderful conference!

Olha Yaroshko, Ukraine

I am thankful to the EDGG and IAVS grant committee for the financial support they gave me to participate in the 16th Eurasian Grassland Conference 2019 in Graz.

It is the first time I have participate in an EGG conference, and the first large-scale conference in my life. The conference program was very eventful. There were a lot of interesting poster presentations.

During the conference, I obtained new knowledge and practical skills in identifying plants during the mid-conference excursion to the mountains. I am glad that I met new people, I was very pleased to talk with Didem, Idoia, Martin and Iwona, I will remember them for a long time. I also met several young scientists, most of all, I remember Iris from Belgium and I had the opportunity to share my experience with her, her PhD work is also related to the introduction of plants *in vitro* culture and the propagation of plants. Also, unexpectedly for me, I met participants from Ukraine, with whom I was previously familiar (I did not know that they would participate in the conference).

The conference in 2019 was held in the city of Graz (Austria), the mid-conference excursion was held in the mountains around the village of Neumarkt. The conference venue and excursions were successfully chosen. Graz is a very old city, the second after Vienna in economic importance. In the town of Graz, I was impressed with the Graz botanical garden, with a large collection of tropical plants. The collections of botanical gardens are of direct interest for me. I worked in two botanical gardens in Kyiv and previously specially visited botanical gardens in Ukraine and other countries, growing plants is my job and a hobby that I adore. Most of all I was impressed with the conference in the mountains. I have never been to such high mountains. The wildlife in these mountains is wonderful. I, with several participants from Ukraine, found several species of rare orchids during the excursion tour. I got acquainted with the species diversity of mountain meadows and forests in the area of the village of Neumarkt. Now it's hard for me to describe the emotions that I experienced in the mountains. It was a delight and ecstasy from the beauty of nature, fresh and clean mountain air and the aromas of herbs and moist soil, which harmoniously merged into a single picture. Thanks to the organizers, you gave me not just the opportunity to present my work and exchange knowledge, you gave me emotions and inspiration.

PS: In 2020, the Field Workshop will be held in Ukraine. If anybody (I mean participants), has the desire and opportunity to get acquainted with the nature of not only southern and central Ukraine – You are welcome, I can be "an excursion guide". In Ukraine, we have the Carpathian Mountains - the pearl of Ukraine. You can contact me about Ukraine nature information. Hope to see all new friends at the next conferences.

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GrassPlot v. 2.00 – first update on the database of multi-scale plant diversity in Palaearctic grasslands

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Abstract: GrassPlot is a collaborative vegetation-plot database organised by the Eurasian Dry Grassland Group (EDGG) and listed in the Global Index of Vegetation-Plot Databases (GIVD ID EU-00-003). Following a previous Long Database Report (Dengler et al. 2018, *Phytocoenologia* 48, 331–347), we provide here the first update on content and functionality of GrassPlot. The current version (GrassPlot v. 2.00) contains a total of 190,673 plots of different grain sizes across 28,171 independent plots, with 4,654 nested-plot series including at least four grain sizes. The database has improved its content as well as its functionality, including addition and harmonization of header data (land use, information on nestedness, structure and ecology) and preparation of species composition data. Currently, GrassPlot data are intensively used for broad-scale analyses of different aspects of alpha and beta diversity in grassland ecosystems.

Keywords: biodiversity; community ecology; Eurasian Dry Grassland Group (EDGG); Global Index of Vegetation-Plot Databases (GIVD); grassland vegetation; GrassPlot; macroecology; nested plot; Palaearctic; scale dependence; species-area relationship (SAR); vegetation-plot database.

Abbreviations: EDGG = Eurasian Dry Grassland Group; EVA = European Vegetation Archive; GIVD = Global Index of Vegetation-Plot Databases; GrassPlot = Database of Scale-Dependent Phytodiversity Patterns in Palaearctic Grasslands; SAR = species-area relationship.

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Introduction

Since 2009, the Eurasian Dry Grassland Group (EDGG) has been conducting Field Workshops in various regions of the Palaearctic realm to collect high-quality multi-scale diversity and composition data of various, mostly dry grassland types (e.g. Turtureanu et al. 2014; Kuzemko et al. 2016; Polyakova et al. 2016; for overview of the sampled data, see Dengler et al. 2016a) following the same sampling methodology (Dengler et al. 2016b). In March 2017, the establishment of the collaborative vegetation-plot database GrassPlot allowed merging the data collected by the EDGG with the previously established "Database Species-Area Relationships in Palaearctic Grasslands" (Dengler et al. 2012). The resulting GrassPlot database is registered in the Global Index of Vegetation-Plot Databases (Dengler et al. 2011) under ID EU-00-003 (Dengler et al. 2018) and contains vegetation-plot data of grasslands in the widest sense (i.e. any vegetation type except forests, tall shrublands, aquatic and segetal communities) from the Palaearctic biogeographic realm (i.e. Europe, North Africa, and West, Central, North and Northeast Asia). The focus of GrassPlot is on data of precisely delimited plots, both multi-grain, nested-plot data of any plot size and single-grain data matching one of eight EDGG standard grain sizes (Dengler et al. 2018).

The purpose of GrassPlot is to provide quality data for broad-scale analyses of various aspects of vegetation diversity. The concept of GrassPlot and the content of its first public version 1.00 have been described by Dengler et al. (2018). Since this publication, GrassPlot data have been intensively used for broad-scale biodiversity analyses, such as species-area relationships (SARs) in continuous vegetation (Dengler et al. 2019), or manuscripts in preparation on small-scale beta diversity, and "benchmarking" Palaearctic grassland diversity. At the same time, the content and functionality of GrassPlot have significantly increased. This paper provides an overview of the improvements in the structure and content of the database since version 1.00.

New functionalities

Addition and harmonization of header data

Information on nestedness. GrassPlot includes both single-grain data (hereafter individual plots) and nested-plot data consisting of subplots of several grain sizes, often replicated per grain size. All subplots of a nested series are included in one macro plot or mother plot, also with a complete species list (hereafter largest subplot). We have added several binary (Y/N) header data to document different aspects of nestedness: *Individual plot*, *Independent plot* (individual plots and largest subplots combined), *Belonging to nested series with at least 2 sizes, Belonging to nested series with at least 4 sizes, Belonging to nested series with at least 7 sizes,* and *Perfect nesting.* The latter indicates if the nested series corresponds to a perfect nesting or not, e.g., if all subplots of a certain size are included in the next larger subplot (Fig. 1). The additional column *Distorting sizes* indicates which are the grain sizes that are impeding the perfect nesting; if these distorting sizes were removed, a perfect nesting would result. Fig. 1 shows schemes of the three main types of nested sampling designs in GrassPlot, two with perfect nesting (Figs. 1a, 1b) and a third one with non-perfect nesting (Fig. 1c).

Grassland types and biomes. Data collected in GrassPlot represent different types of grasslands in the broadest sense. To allow future users and projects to deal with this considerable diversity of vegetation, we created a two-level vegetation typology with 22 vegetation types grouped into six broad groups: natural grasslands, secondary grasslands, azonal habitats, dwarf shrublands, tall forb and ruderal communities, and deserts and semi-deserts (Table 1). We also created expert rules to assign phytosociological syntaxa already included in GrassPlot to these 22 vegetation types (Table 2). Vegetation type was assigned based on phytosociological affinity or on other information provided by data

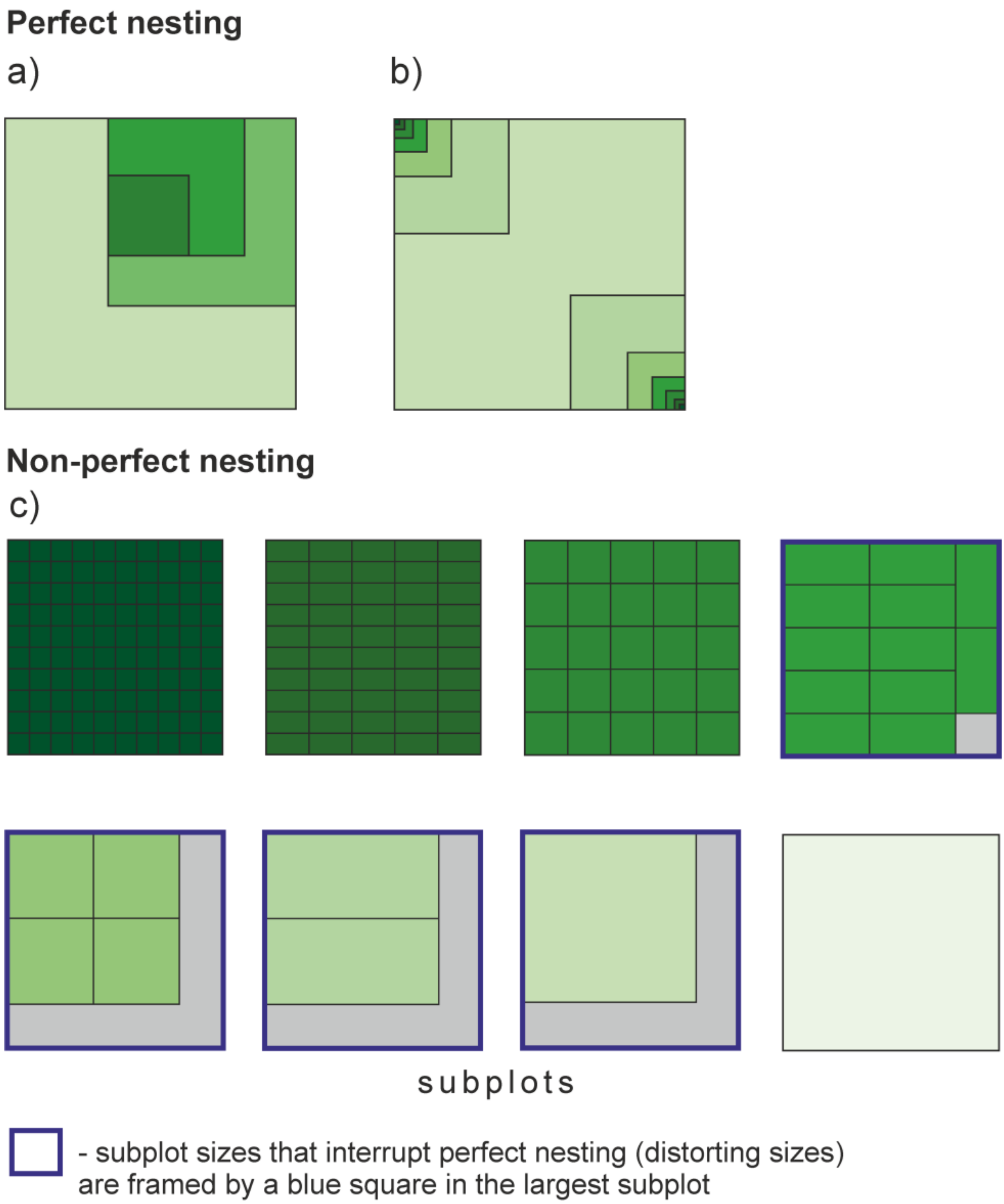


Fig. 1. Examples of nested-plot sampling schemes found in the GrassPlot database: a) perfect nesting with four grain sizes, without replication of the subplots; b) perfect nesting with eight grain sizes and replication at smaller grain sizes (field sampling standard with two replicates of each grain size except the largest, which is used during EDGG Field Workshops; for details see Dengler et al. 2016b), c) non-perfect nesting with eight grain sizes, where the smallest subplots completely tessellate the largest subplot. In this example, a typical GLORIA sampling design is shown (Pauli et al. 2012). Only the smallest subplots and the largest one are actually sampled in the field, while all intermediate subplot sizes are created post hoc by joining species lists of adjacent subplots. To achieve more different grain sizes, we accepted some that did not allow full tessellation of the largest subplot (see grey areas adjacent to subplots of grain sizes 4-7) and thus distorted the perfect nesting. When the distorting sizes of subplots were removed, a perfect nesting would result.

Table 1. Two-level vegetation typology applied in GrassPlot v. 2.00. Since the assignments to the vegetation types and groups were largely based on syntaxonomy, there are some grey zones, e.g. some xeric grasslands might be secondary.

Group	Vegetation type
Natural grasslands	Alpine grasslands
	Alpine steppes
	Rocky grasslands
	Xeric grasslands and steppes
Secondary grasslands	Wet grasslands
	Mesic grasslands
	Meso-xeric grasslands
	Mediterranean grasslands
	Sandy dry grasslands
Azonal habitats	Wetlands
	Saline communities
	Dunes
	Rocks and screes
	Saline steppes and semi-deserts
Dwarf shrublands	Arctic-alpine heathlands
	Lowland heathlands
	Garrigues and thorn cushion communities
Tall forb and ruderal communities	Tall forb and fringe communities
	Ruderal communities
Deserts and semi-deserts	Alpine deserts
	Cold deserts and semi-deserts
	Warm deserts and semi-deserts

collectors, e.g., vernacular names, species composition, localisation, and so on.

We also assigned each plot both to biomes and to geographic regions. For biomes, we used the recent classification by Bruelheide et al. (2019, based on Schultz 2005), which recognizes ten terrestrial biomes, all of them occurring in the Palaearctic realm, except "Tropics with year-round rain". We have assigned all plots in GrassPlot to one of these nine biomes using plot coordinates. As a result, all biomes present in the Palaearctic realm except "Tropics with summer rain", that occurs marginally on the Arabian Peninsula, are represented in GrassPlot. For geographic regionalization, we used Török & Dengler (2018) and Dengler et al. (in press).

Land-use data. Land use is the main current driver of biodiversity change and loss worldwide (Collins et al. 1998). Vegetation survey databases provide spatially explicit information on local biodiversity (richness and/or composition). However, associated land-use information is generally scarce (but see Niedrist et al. 2009; Hudson et al. 2014). The lack of reliably coupled biodiversity and land-use data at a local scale that is available over large geographic extents substantially impedes our understanding of how biodiversity responds to anthropogenic environmental change.

The current version of GrassPlot now includes consistent and standardized information on the land use and land-use intensity of the plots. Information on land-use was provided by data contributors with different degrees of detail. It has been structured into 19 different land-use variables, created to capture as much information as possible from existing datasets. The structure of the land-use data has been developed to meet the needs of future analyses regarding land use-data and to guide future sampling efforts. The 19 land-use variables are structured into four categories: land-use type (seven variables), land-use intensity and details (relative to each land-use type), land destination (for what purpose the land is used) and naturalness degree (see Table 3). Each grassland has one or several land-use types (for example it can be mown and fertilized), and a grassland can be mown for different purposes (land destination) such as farming (feeding cattle) or managing a public park (recreational destination). Land destination is a coarse categorisation which is expected to include several types of management practices.

Importantly, all plots of the GrassPlot database (190,673 plots) now have a land-use type, while other land-use variables are not available for all plots, indicated as NA (Table 3). Moreover, the variable *Naturalness degree* is still under development, and will be added when it is computed.

Environmental and structural data. GrassPlot v. 2.00 has also notably improved the coverage and consistency of several environmental and structural header data, which are stored with standardized measurement units. Topographic data are readily and consistently available for many plots with different degrees of coverage, e.g. 88% for *Elevation*, 34% for *Aspect* and *Inclination,* 5% for *Microrelief*. Microrelief is defined as the maximum distance to the ground when placing a stick on the ground in the most rugged part of the plot, measured perpendicular to the stick. The soil data with better coverage are *pH* H_2O (15%), *Soil texture class* (14%), *Conductivity* (10%) and *Soil depth* (10%). Of the structural header data, *Tree cover* (95%), *Shrub cover* (50%), *Herb cover* (49%), *Total vegetation cover* (39%) and *Cryptogam cover* (37%) are the variables with better coverage. Additionaly, *Litter cover* is provided for 31% of plots, *Proportion of stones, gravel and fine soil* for 21% of plots and *Mean height of the herb layer* for 13% of plots. All environmental and structural data stored in GrassPlot have been directly measured or estimated in the field, or, in the case of soil parameters, in the laboratory using soil samples collected in the plots. Climatic and more complete topographic data can be retrieved from digital models using plot geographic coordinates, but the database is focused on directly measured data. Of course, projects using GrassPlot data may be able to combine them with environmental data extracted from digital models.

Preparation of species composition data

As reported by Dengler et al. (2018), the GrassPlot database also includes species composition data for most datasets (93%). This means that for 90.7% of the plots (Table 4), in addition to species richness data, there is also a complete list of vascular plant species and often also of lichens and

Table 2. Assignment rules for phytosociological syntaxa to the 22 vegetation types as defined in GrassPlot v. 2.00, given at class level. Classes occurring in Europe are named after Mucina et al. (2016), classes from outside Europe according to various sources (Ermakov & Krestov 2009; Wehrden et al. 2009; Ermakov et al. 2014; Noroozi et al. 2014; Reinecke et al. 2017; Hüseynova & Yalçin 2018; Nowak et al. 2018). Classes absent in GrassPlot data are not shown in the table. For the classes with the notation *p.p.*, the assignment is made at order or alliance level (not shown here).

Class	Vegetation type
Adiantetea	Rocks and screes
Ajanio-Cleistogenetea songoricae p.p.	Alpine deserts
Ajanio-Cleistogenetea songoricae p.p.	Cold deserts and semi-deserts
Ammophiletea	Dunes
Artemisietea lerchianae	Cold deserts and semi-deserts
Artemisietea vulgaris	Ruderal communities
Arundinello anomalae-Agrostietea trinii	Mesic grasslands
Asplenietea trichomanis	Rocks and screes
Astragalo microcephali-Brometea tomentelli p.p.	Garrigues and Thorn cushion communities
Astragalo microcephali-Brometea tomentelli p.p.	Xeric grasslands and steppes
Bidentetea	Ruderal communities
Cakiletea maritimae	Dunes
Calamagrostietea langsdorfii	Wet grasslands
Calluno-Ulicetea	Lowland heathlands
Carici rupestris-Kobresietea bellardii	Alpine grasslands
Chenopodietea	Ruderal communities
Cleistogenetea squarrosae	Xeric grasslands and steppes
Crithmo-Staticetea	Saline communities
Didymophyso aucheri-Dracocephaletea aucheri	Rocks and screes
Digitario sanguinalis-Eragrostietea minoris	Ruderal communities
Elyno-Seslerietea	Alpine grasslands
Epilobietea angustifolii	Ruderal communities
Festucetea indigestae p.p	Alpine grasslands
Festucetea indigestae p.p	Sandy dry grasslands
Festuco hystricis-Ononidetea striatae p.p.	Rocky grasslands
Festuco hystricis-Ononidetea striatae p.p.	Garrigues and Thorn cushion communities
Festuco-Brometea p.p.	Xeric grasslands and steppes
Festuco-Brometea p.p.	Meso-xeric grasslands
Festuco-Brometea p.p.	Rocky grasslands
Festuco-Puccinellietea	Saline steppes and semi-deserts
Helianthemetea guttati	Mediterranean grasslands
Helichryso-Crucianelletea maritimae	Dunes
Isoëto-Nanojuncetea	Wetlands
Juncetea maritimi	Saline communities
Juncetea trifidi	Alpine grasslands
Kleinio-Euphorbietea canariensis	Warm deserts and semi-deserts
Koelerio-Corynephoretea canescentis	Sandy dry grasslands
Littorelletea uniflorae	Wetlands
Loiseleurio procumbentis-Vaccinietea	Arctic-alpine heathlands
Lygeo sparti-Stipetea tenacissimae	Mediterranean grasslands
Molinio-Arrhenatheretea p.p.	Mesic grasslands
Molinio-Arrhenatheretea p.p.	Tall forb and fringe communities
Molinio-Arrhenatheretea p.p.	Wet grasslands
Montio-Cardaminetea	Wetlands
Mulgedio-Aconitetea	Tall forb and fringe communities
Nardetea strictae p.p.	Mesic grasslands
Nardetea strictae p.p.	Wet grasslands
Onobrychidetea cornutae	Garrigues and Thorn cushion communi-ties
Ononido-Rosmarinetea	Garrigues and Thorn cushion communi-ties
Oxycocco-Sphagnetea	Wetlands
Oxytropidetea persicae	Arctic-alpine heathlands
Papaveretea rhoeadis	Ruderal communities
Phragmito-Magnocaricetea	Wetlands
Poetea bulbosae	Mediterranean grasslands
Polygono-Poetea annuae	Ruderal communities
Polypodietea	Rocks and screes
Prangetea ulopterae	Tall forb and fringe communities
Rhododendro hirsuti-Ericetea carneae	Arctic-alpine heathlands
Rumici-Astragaletea siculi	Garrigues and Thorn cushion communi-ties
Saginetea maritimae	Saline communities
Salicetea herbaceae	Arctic-alpine heathlands
Salicornietea fruticosae	Saline communities
Scheuchzerio palustris-Caricetea fuscae	Wetlands
Sedo-Scleranthetea	Rocky grasslands
Sisymbrietea	Ruderal communities
Spartinetea maritimae	Saline communities
Stipo giganteae-Agrostietea castellanae	Mediterranean grasslands
Stipo-Trachynietea distachyae	Mediterranean grasslands
Therosalicornietea	Saline communities
Thlaspietea rotundifolii	Rocks and screes
Trifolio-Geranietea sanguinei	Tall forb and fringe communities

Table 3. Land-use variables in GrassPlot v. 2.00 and the percentage of plots for which the information is available (% F). The percentages refer to the independent plots (*N* = 28,171). For binary variables, the column "% 1 in F" indicates the percentage frequency of the management technique among the plots that have this land-use information. Some plots have a combined land use (mown and grazed; natural and grazed; etc.), so the sum of plots in each specific land use can exceed the total number of plots in GrassPlot. "NA" indicates missing information.

Variable group	Variable name	Variable type	Possible values	% F (no NA)	% 1 in F (no 0, no NA)
Land-use type	Mown	binary	0/1	90.3	11.3
	Grazed	binary	0/1	89.3	62.8
	Burnt	binary	0/1	69.2	2.3
	Fertilized	binary	0/1	65.0	2.2
	Abandoned	binary	0/1	67.2	19.1
	Natural	binary	0/1	45.0	49.0
	Other	text	free		
Land-use intensity and details	Grazing intensity	numeric	0 to 1	28.6	
	Grazing load	numeric	0 to infinity	9.8	
	Grazing animal	text	free	18.3	
	Mowing frequency	numeric	0 to infinity	10.4	
	Burning frequency	numeric	0 to 1	2.3	
	Fertilization intensity	numeric	0 to 1	12.9	
	Fertilization type	text	synthetic/natural	0.9	
	Fertilization details	text	free	0.9	
	Years since abandonment	numeric	0 to infinity	2.2	
	Abandonment: former land use	text	arable, mown, grazed	7.1	
Land destination	Land destination	text	cropland, farmland, recreational	33.2	
Naturalness	Naturalness degree	numeric	0 to 3	-	

bryophytes, either as presence/absence or cover-abundance information. This is the result of the work carried out between GrassPlot versions 1.00 and 2.00 to integrate the species composition data into a single uniform structure.

Most of the datasets were supplied as species × plot matrices ("wide tables"). Since such wide format data are neither suitable for merging into a single dataset nor can be filtered for functional groups or vegetation layers, they were transformed into a "long format" (see example in Appendix 1) using different packages suitable for data manipulation in R (e.g. *plyr, dplyr* and *tidyr*) (Wickham et al. 2017; Wickham & Henry 2019). In the long format, each row consists of a species record, i.e., an occurrence of a species in a plot or subplot. Additional columns provide information on plant group, vegetation layer, species abundance and abundance-scale. *Abundance-scale* is a binary column, indicating whether the value in *Abundance* column is a presence/absence value (P/A = 0/1) or a cover-abundance value at the percentage scale (cover: 0-100). Cover abundance values that

Table 4. Overview of some key parameters of GrassPlot v. 2.00 covering access regime, methodological aspects and temporal and elevational distribution. The column "NA" indicates the fraction of plots in GrassPlot v. 2.00 for which the respective field is currently without content. The percentages refer to the independent plots (*N* = 28,171).

Parameter	NA	Frequency distribution of parameter values
Availability of data		
Access regime	< 0.1%	1 – restricted access (12.0%); 2 – semi-restricted access (86.2%); 3 – free access (1.7%)
Availability of compositional data	–	Yes-ready (10.0%); Yes-in preparation (80.7); to be provided later (5.4%); no (3.8%)
Methodological aspects		
Recording method	0.2%	Shoot presence (69.9%); rooted presence (29.9%)
Plot shape	0.1%	Squares (81.6%); rectangles 1:1.6 (0.2%); rectangles more elongated than 1:2 (0.3%); circles (18.0%)
Accuracy of coordinates	0.4%	≤ 1 m (18.3%); 1.1–10 m (47.5%); 11–100 m (12.3%); 101–1,000 m (16.4%); > 1,000 m (5.2%)
Spatio-temporal distribution		
Year of recording	-	Before 1980 (0.1%); 1980–1989 (10.5%); 1990–1999 (13.3%); 2000–2009 (17.7%); 2010 and later (59.3%)
Elevation	12.0%	≤ 10 m a.s.l. (14.9%); 11–100 m a.s.l. (9.2%); 101–1,000 m a.s.l. (28.8%); 1,001–2,000 m a.s.l. (20.1%); 2,001–3,000 m a.s.l. (8.5%); 3,001–4,000 m a.s.l. (3.7%); > 4,000 m a.s.l. (2.8%)

were originally measured by means of categorical scales (e.g. different variants of Br.-Bl., Londo, and so on) have already been transformed to percentage during the wide data format by choosing the midpoint of the upper and lower boundaries of a cover class. The original cover-abundance scale has been stored in the database together with all other plot-level metadata, plus geographic, environmental, land-use and structural data. Species composition long-format tables also maintain relevant metadata such as the GrassPlot ID of the single plot or subplot of a nested-series, the ID of the largest subplot within which the subplot is nested (only for nested-plots) and its grain size. This data structure allows data to be combined within and across datasets for later analyses on species composition either by using the long format or reshaping it into a wide format of species × plot matrices.

While the data are being prepared in a long format, progress is also being made to develop a process to semi-automatically adjust species nomenclature, i.e. correcting typographical errors and homogenizing different levels of identification detail and differences in species name format (e.g. removing authorities from taxon names). This allows taxon names to be standardized according to “The Plant List” (www.theplantlist.org), using the *taxonstand* package (Cayuela et al. 2012) in R (R Core Team 2019). In addition, we plan to add a column named "determ_qual" to indicate for each taxon its quality of determination: 1 – determined to the species level (e.g. *Viola arvensis*), 0.5 – determination to species level not certain (e.g. *Viola arvensis aggr*., *Viola cf. arvensis, Viola arvensis/kitaibeliana*), 0.2 – species unknown (species epithet missing); 0 – genus unknown (e.g. *Violaceae*). This would allow us to calculate a "species composition quality" index for each plot as follows: the sum of the "determ_qual" values of each species in the plot divided by the total number of species. This "species composition quality" index ranges from 1 (all taxa are determined at least to the species level) to 0 (taxa at family level). The proportion of species determined to different levels will be calculated for each plot and various thresholds (based on project aims) can be used to filter out plots that do not meet species composition quality criteria.

The last step in the process of harmonizing the composition data involves dealing with homonyms and synonyms originating from different concepts of species names. Many contributed datasets also provide information on the reference flora, but collaboration with data providers will be crucial in this last step.

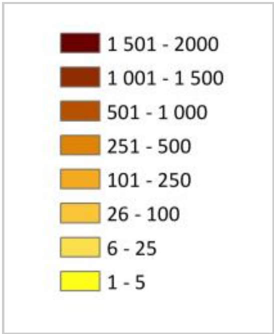
Currently, 76 out of the 171 datasets for which composition data have been provided to GrassPlot are already available in long format.

Content of GrassPlot v. 2.00

The current GrassPlot version 2.00 of 7 November 2019 contains data from 184 contributing datasets, i.e. 59 (47%) more compared to GrassPlot version 1.00 (Dengler et al. 2018). The newly contributed datasets are listed in Appendix 2. In total, the database now contains 190,673 plots of different grain sizes (+21,676 plots or 13% added to version 1.00), corresponding to 28,171 independent plots. Among these are 22,422 individual plots (single-grain data) and 5,749 nested-plot series with at least two grain sizes (often consisting of several subseries), of which 4,654 contain at least four grain sizes (+1,857 or 66%) and 2,057 even seven and more grain sizes. Most contributors have assigned their plots to the “semi-restricted access” regime, but a few have allocated their plots to the “restricted access” or “free access” categories (Table 4).

GrassPlot comprises data over a wide geographic range, from the Canary Islands (Tenerife) in the west (16.3° W) to Kamchatka in the east (161.7° E) and from Nepal in the south (28.2° N) to Svalbard (Norway) in the north (77.9° N). The highest density of plots were recorded in temperate Europe (Figs. 2 and 3). In total, the plots originate from 47 countries, with Spain having the highest number (58,977 plots) and Austria the highest density (16.58 plots per 100 km²) of the total plots. Switzerland has the highest number (5,172 plots) and Andorra the highest density (16.45 plots per 100 km²) of independent plots (Table 5). Data locations range from sea level to 5,750 m a.s.l., with the largest fraction of independent plots coming from 101–1,000 m a.s.l. (Table 4). Sampling year is one of the metadata included for each plot, and this shows that data were sampled between 1948 and 2018, with 59.3% of all independent plots surveyed between 2010–2019 (Table 4). Currently, 98% of all independent plots have been assigned to one of 22 vegetation types (Table 6), with 79% of plots being syntaxonomically assigned to a class and/or subordinate syntaxa. Natural grasslands, secondary grasslands and azonal habitats are the most frequent broad groups. Within these groups, alpine grasslands and xeric grasslands and steppes, meso-xeric and mesic grasslands and saline communities and wetlands, respectively, are the most frequent vegetation types (Table 6). With respect to azonal communities, *Juncetea maritimi* and *Scheuchzerio palustris-Caricetea fuscae* are the most frequent phytosociological classes in saline communities and wetlands, respectively. The distribution of phytosociological classes across the natural and secondary grassland types is shown in Fig. 4. The temperate dry grassland class *Festuco-Brometea* (23%) is present in rocky grasslands, meso-xeric grasslands and xeric grasslands and steppes, but most plots correspond to meso-xeric grasslands. The class *Molinio-Arrhenatheretea* (12%) is well represented in mesic and wet grasslands, while the best-represented classes in alpine and sandy dry grasslands are *Juncetea trifidi* and *Koelerio-Corynephoretea canescentis*, respectively (Fig. 4).

The most frequent standard-plot sizes are 0.01 m², followed by 1 m² and 9–10 m² (Table 7). Data of the complete vegetation (vascular plants, and terricolous bryophytes and lichens) are available for 16,515 plots (8.7%) (Table 7). Methodologically, the majority of contributors used shoot sampling rather than rooted sampling (Table 4), which can make a big difference for the assessment of vascular plant richness at small spatial grains (Dengler 2008; Güler et al. 2016; Cancellieri et al. 2017). Among plot shapes, squares were



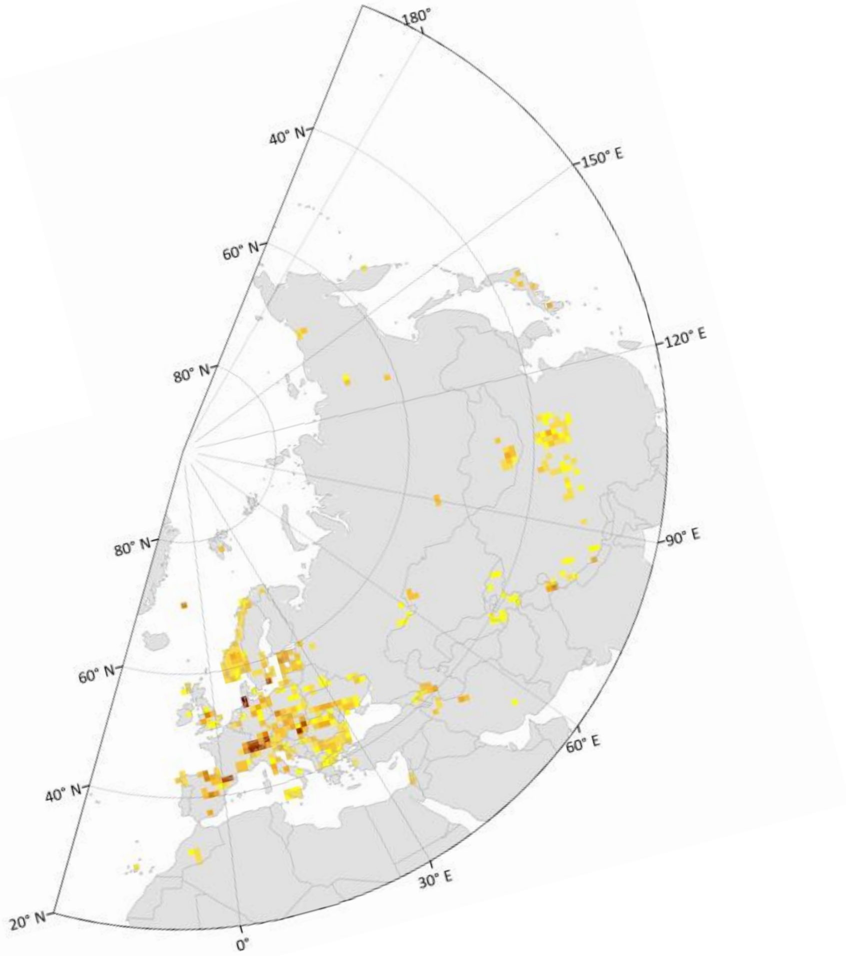
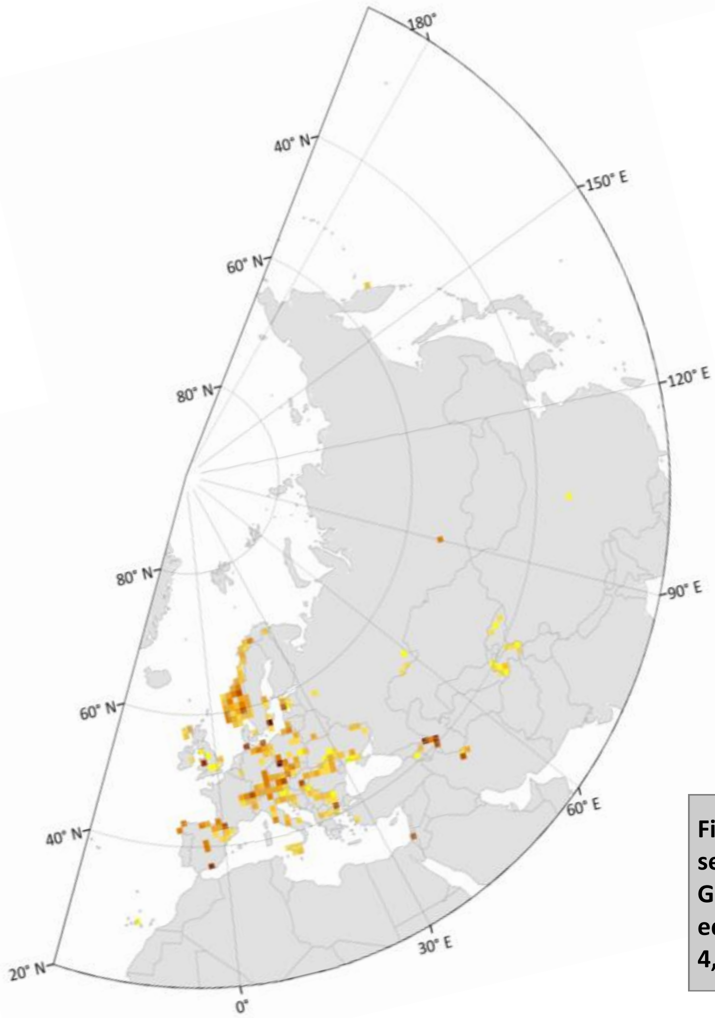


Fig. 2. Spatial distribution of the independent plots contained in GrassPlot v. 2.00 shown as plot density in equally-sized grid cells of 10,000 km^2 (*N* = 28,171).



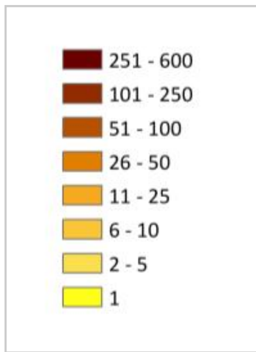


Fig. 3. Spatial distribution of the nested-plot series with at least four grain sizes contained in GrassPlot v. 2.00 shown as plot density in equally-sized grid cells of 10,000 km^2 (*N* = 4,654).

Table 5. Number (*N*) and density of plots per country (or dependent territory), sorted by decreasing density of independent plots (*N* = 28,171). The twenty five countries with the highest densities are listed. Area [km²] refers to the size of the respective territory. For comparison columns N_{all} and N_{all} / 100 km² provide numbers and densities of all plots for the listed countries (N_{all} = 190,673).

Code	Country	Area [km²]	*N*	*N* / 100 km²	N_{all}	N_{all} / 100 km²
AD	Andorra	468	77	16.45	77	16.45
CH	Switzerland	41,285	5,172	12.52	6,134	14.86
HU	Hungary	93,030	2,638	2.84	4,320	4.64
EE	Estonia	45,100	832	1.84	1,578	3.50
AT	Austria	83,855	1,401	1.67	13,899	16.58
DE	Germany	356,840	3,684	1.03	8,359	2.34
ES	Spain	504,790	3,451	0.68	58,977	11.68
AZ	Azerbaijan	86,600	408	0.47	2,033	2.35
SJ	Svalbard and Jan Mayen	61,397	280	0.46	280	0.46
IL	Israel	20,724	82	0.39	1,795	8.66
LV	Latvia	64,589	250	0.39	250	0.39
CZ	Czech Republic	78,864	280	0.36	1,396	1.77
BE	Belgium	30,688	90	0.29	90	0.29
BG	Bulgaria	110,910	315	0.28	844	0.76
HR	Croatia	56,594	160	0.28	227	0.40
NO	Norway	323,758	911	0.28	15,292	4.72
SK	Slovakia	49,035	139	0.28	477	0.97
IT	Italy	301,245	742	0.25	15,120	5.02
UK	United Kingdom	244,587	586	0.24	3,756	1.54
SE	Sweden	440,940	1,000	0.23	26,219	5.95
PL	Poland	312,685	620	0.20	3,148	1.01
RO	Romania	238,397	436	0.18	1,354	0.57
SI	Slovenia	20,273	37	0.18	37	0.18
UA	Ukraine	603,628	765	0.13	2677	0.44
RS	Serbia	77,453	119	0.15	533	0.69

most frequently employed (82%), followed by circles (18%) but rectangles are rarer. GrassPlot's geographic coordinates most often have an accuracy of < 1 km and in 18%, of < 1 m (Table 4).

As explained above, header data in GrassPlot also hold many structural (e.g. cover and height of vegetation layers, biomass) and ecological (e.g. topography, soil, land use) parameters that have harmonized terminology and units of measurement. The distribution of plots across biomes and regions is shown in Fig. 5 and Table 8, respectively.

Governance, applications and outlook

GrassPlot is a self-governed consortium, associated with the Eurasian Dry Grassland Group (EDGG). The data contributors remain owners of their data and become members of the consortium. Every two years, the consortium elects from its members a seven-strong Governing Board. Since 27 February 2019, the Governing Board is composed of Jürgen Dengler (Switzerland; custodian), Idoia Biurrun (Spain, deputy custodian and database manager), Sabina Burrascano (Italy), Iwona Dembicz (Poland and Switzerland), Riccardo Guarino (Italy), Jutta Kapfer (Norway) and Remigiusz Pielech (Poland). Other consortium members act as additional data managers, such as Itziar García-Mijangos, Salza Palpurina, Anne Mimet, Corrado Marcenò and Vincent Pellissier. Rights and duties of data contributors and data users are regulated in Bylaws, of which a slightly modified version was adopted by the GrassPlot Consortium on 1 January 2019. The GrassPlot website is currently hosted at the Ecoinformatics Portal Bayreuth (https://bit.ly/2HvVkgu), but will be transferred shortly to the new EDGG website (http://www.edgg.org).

As already mentioned, the purpose of GrassPlot is to provide high-quality data for broad-scale analyses of various aspects of vegetation diversity. According to the GrassPlot Bylaws, members of the consortium can request data for research projects (and non-members can join up with a member to do so). Currently, one such paper project has been completed and three are under way. Dengler et al. (2019) recently analysed which function best describes species-area relationships (SARs) in Palaearctic grasslands. In a follow-up paper (J. Dengler, I. Dembicz et al., in prep.), the authors will test how the exponent of the power function (*z*-value) as a measure of small-scale beta-diversity depends on taxonomic group, vegetation type and site conditions. Furthermore, an overview of mean, minimum and maximum richness data of Palaearctic grasslands across regions, vegetation types, taxa and scales will serve as a major benchmarking tool both for fundamental research and conservation and is well-developed (I. Biurrun et al. in prep.). In addition, an online reference database is planned for publication along with this study. Finally, the relationship between sampling grain and beta-diversity is now being tested

Table 6. Distribution of plots in GrassPlot v. 2.00 across the 22 vegetation types and five broad groups. *N* = number of independent plots in each vegetation type and broad group; % GP = proportion of independent plots of each vegetation type in GrassPlot; % VT = proportion of independent plots of a phytosociological class inside each vegetation type. If the values in % VT do not sum up to 100% within one vegetation type, this is due to plots without assignment to a phytosociological class, and also due to the fact that only classes with more than 10% VT are shown (with some exceptions). [NA] in the column *Group* indicates the number of plots that have not been assigned to any vegetation type. [NA] in the column *Phytosociological class* indicates that plots of this vegetation type do not have phytosociological assignment; assignation to vegetation type has been made manually.

Group	Vegetation type	*N*	% GP	Phytosociological class	% VT
Natural grasslands (*N* = 6,222)	Alpine grasslands	3,023	10.7	*Elyno-Seslerietea*	12.5
				Festucetea indigestae	7.3
				Juncetea trifidi	50.5
	Alpine steppes	89	0.3	[NA]	-
	Rocky grasslands	948	3.4	*Festuco hystricis-Ononidetea striatae*	24.6
				Festuco-Brometea	56.6
				Sedo-Scleranthetea	14.1
	Xeric grasslands and steppes	2,162	7.7	*Cleistogenetea squarrosae*	7.2
				Festuco-Brometea	67.5
Secondary grasslands (*N* = 11,902)	Wet grasslands	1,375	4.9	*Molinio-Arrhenatheretea*	79.2
	Mesic grasslands	3,627	12.9	*Molinio-Arrhenatheretea*	59.9
	Meso-xeric grasslands	4,542	16.1	*Festuco-Brometea*	96.7
	Mediterranean grasslands	817	2.9	*Lygeo sparti-Stipetea tenacissimae*	18.7
				Stipo-Trachynietea distachyae	72.7
	Sandy dry grasslands	1,541	5.5	*Koelerio-Corynephoretea canescentis*	88.3
Azonal habitats (*N* = 7,333)	Wetlands	2,700	9.6	*Oxycocco-Sphagnetea*	10.9
				Phragmito-Magnocaricetea	13.2
				Scheuchzerio palustris-Caricetea fuscae	70.9
	Saline communities	2,931	10.4	*Juncetea maritimi*	70.5
	Dunes	953	3.4	*Ammophiletea*	43.7
				Helichryso-Crucianelletea maritimae	50.1
	Rocks and screes	356	1.3	*Didymophyso aucheri-Dracocephaletea aucheri*	22.1
				Thlaspietea rotundifolii	27.2
	Saline steppes and semi-deserts	393	1.4	*Festuco-Puccinellietea*	100
Dwarf shrublands (*N* = 900)	Arctic-alpine heathlands	451	1.6	*Loiseleurio procumbentis-Vaccinietea*	20.6
	Lowland heathlands	116	0.4	*Calluno-Ulicetea*	31.8
	Garrigues and Thorn cushion communities	333	1.2	*Festuco hystricis-Ononidetea striatae*	2.4
				Onobrychidetea cornutae	2.4
				Ononido-Rosmarinetea	3.6
Tall forb and ruderal communities (*N* = 724)	Tall forb and fringe communities	271	1.0	*Molinio-Arrhenatheretea*	35.4
				Mulgedio-Aconitetea	28.0
				Trifolio-Geranietea sanguinei	26.9
	Ruderal communities	453	1.6	*Artemisietea vulgaris*	18.9
				Epilobietea angustifolii	34.4
Deserts and semi-deserts (*N* = 559)	Alpine deserts	11	< 0.1	*Ajanio-Cleistogenetea songoricae*	72.7
	Cold deserts and semi-deserts	519	1.8	[NA]	-
	Warm deserts and semi-deserts	29	0.1	*Kleinio-Euphorbietea canariensis*	44.8
[NA]	-	531	1.9		

Table 7. Number of plots (*N*), mean richness (S_{mean}) with standard deviation (S_{SD}) and maximum richness (S_{max}) in GrassPlot v. 2.00 across different plot sizes, and for vascular plants and complete terricolous vegetation (vascular plants, bryophytes and lichens), respectively. All plots and subplots have been considered, thus a total of 190,673 plots. Non-standard plot sizes include all other plot sizes (which are collected only in case of nested-plot series). Note that due to different sample sizes (see column *N*), maxima of larger plot sizes can be lower than for maxima of smaller plot sizes or that maxima of complete terricolous vegetation can be lower than maxima of vascular plants only. Information on plot sizes that deviate by a maximum of 10% (e.g. 9 m² vs. 10 m²), is combined in one row because, based on species-area relationships with typical *z*-values between 0.15 and 0.30, the relative difference in richness would only be about 1.6–3.2%, i.e. negligible given the overall variability of the data.

	Vascular plants				**Complete terricolous vegetation**			
Plot size (m²)	*N*	S_{mean}	S_{SD}	S_{max}	*N*	S_{mean}	S_{SD}	S_{max}
0.0001	2,534	1.9	1.6	11	1,797	2.1	1.7	10
0.001 or 0.0009	3,838	3.3	2.1	19	1,738	3.5	13.4	19
0.01	69,525	3.9	17.0	24	2,491	6.6	20.5	29
0.1 or 0.09	4,963	11.3	30.4	43	1,763	11.1	32.5	46
1	22,121	13.9	55.9	79	2,672	18.6	58.0	82
10 or 9	9,964	27.6	75.0	106	2,617	34.5	71.4	101
100	4,634	29.6	89.1	127	962	48.5	94.0	134
1,000 or 900 or 1,024	187	48.0	17.7	134	45	59.0	85.6	123
Non-standard plot sizes	72,907				2,430			
Total	190,673				16,515			

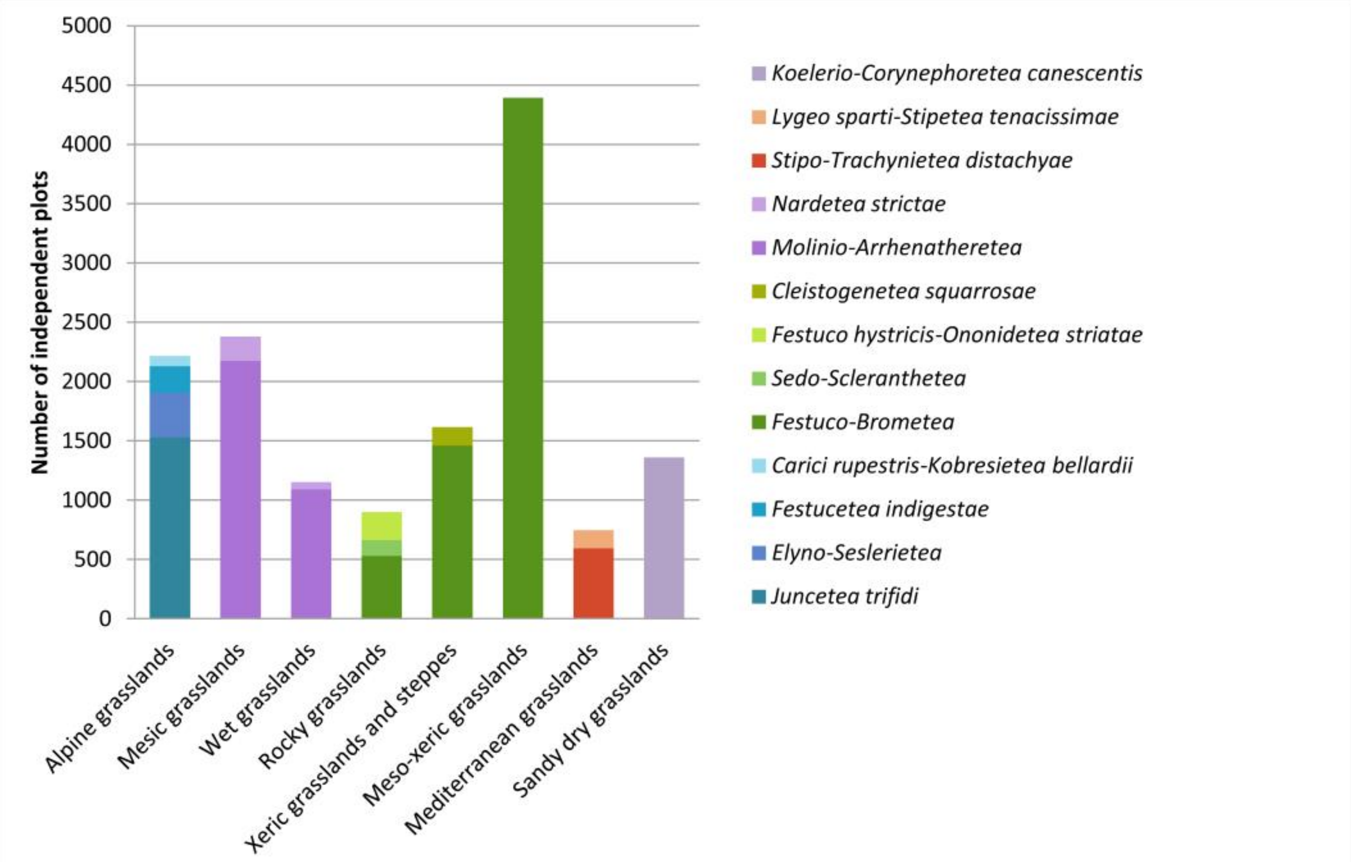


Fig. 4. Frequency of the natural and secondary grassland types and their assignment to phytosociological classes in GrassPlot v. 2.00. Alpine steppes are not represented as they are not assigned to any phytosociological class in GrassPlot. Only independent plots have been considered (*N* = 28,171). Absolute numbers are shown, so that the presence of each class in different vegetation types can be compared.

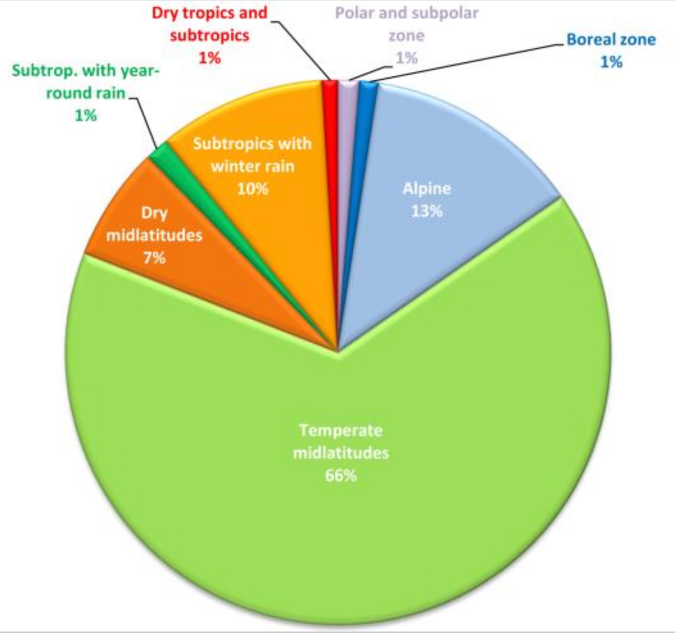


Fig. 5. Distribution of independent plots contained in GrassPlot v. 2.00 (*N* = 28,171) across biomes as defined by Bruelheide et al. (2019).

Table 8. Distribution of independent plots in GrassPlot v. 2.00 according to the regionalization used in *Grasslands of the world* (Török & Dengler 2018) and *Encyclopedia of the world's biomes* (Dengler et al. in press).

Grasslands of the world	*N*	%
Western and Northern Europe	13,343	47.4
Eastern Europe	6,598	23.4
Mediterranean and Middle East	5,301	18.8
China and Mongolia	1,762	6.3
Russia	522	1.9
Japan	418	1.5
Kazakhstan and Middle Asia	227	0.8
Encyclopedia of the world's biomes	*N*	%
Western Europe	14,042	49.8
Eastern Europe	5,455	19.4
Northern Europe	3,281	11.6
Mediterranean	1,779	6.3
China	1,291	4.6
Middle East and Caucasus	685	2.4
Russia	522	1.9
Mongolia	471	1.7
Japan and Korea	418	1.5
Kazakhstan and Middle Asia	227	0.8

across different spatial extents and vegetation types based on composition data (S. Burrascano et al. in prep.).

GrassPlot represents work in progress. Therefore, we welcome new data contributions that meet the specific criteria of GrassPlot (Dengler et al. 2018; GrassPlot website, http://bit.ly/2NZ6A9d). Of particular value are datasets that (largely) follow the standardised EDGG multi-scale sampling (Dengler et al. 2016b), specifically if they come from underrepresented regions or vegetation types (see Figs. 2 and 3, Table 6). However, as GrassPlot does not have external funding, data preparation and harmonisation has to be undertaken voluntarily by the Governing Board and other members and thus it might take a while from data provision to actual inclusion. Likewise, we are also working on improving the completeness and consistency of the header data (methodological, geographic, abiotic, land use, structural information) of the contained plots and increasing the fraction of plots with readily available compositional data. We have agreed with the European Vegetation Archive (EVA; Chytrý et al. 2016) and the global vegetation database "sPlot" (Bruelheide et al. 2019) to contribute GrassPlot data not yet included in these two databases once the compositional data are ready and provided the data owners contribute. This step will fill important data gaps in EVA and sPlot and give our data contributors the opportunity of additional benefit. Last but not least, we hope that the publication of the first macroecological paper from GrassPlot (Dengler et al. 2019) will raise the awareness of the unique qualities of GrassPlot for such studies and spur many more exciting research proposals to be submitted to the Governing Board.

Author contributions

I.B. is the database manager of GrassPlot; she and J.D. planned and led this paper. S.B., I.D., R.G., J.K. and R.P. as further members of the GrassPlot Governing Board as well as I.G.M., V.W., S.P., A.M., V.P, C.M. and A.N. contributed substantially to data preparation, analyses and writting. A.B., S.Bo., A.M.C. J.A.G., A.K., J.A.C., B.E., B.J.A., Z.K., M.M., G.S and K.M added helpful comments, and all other authors contributed data to GrassPlot after v. 1.00, checked and approved the manuscript.

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Appendix 1. Example of species composition in a nested-plot series prepared in long format in GrassPlot v. 2.00.

GrassPlot.plotID	Area.m2	GrassPlot.ID.largest.nested	Species.original	Group	Layer	Abundance	Abundance_Scale
EU_F_N001_0.0001aa	0.0001	EU_F_N001_100	Eryngium maritimum	V	H	1	P/A
EU_F_N001_0.0001ab	0.0001	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	1	P/A
EU_F_N001_0.0001ab	0.0001	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.0001bb	0.0001	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.001aa	0.001	EU_F_N001_100	Eryngium maritimum	V	H	1	P/A
EU_F_N001_0.001ab	0.001	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	1	P/A
EU_F_N001_0.001ab	0.001	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.001bb	0.001	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.01aa	0.01	EU_F_N001_100	Eryngium maritimum	V	H	1	P/A
EU_F_N001_0.01ab	0.01	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	1	P/A
EU_F_N001_0.01ab	0.01	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.01ab	0.01	EU_F_N001_100	Euphorbia paralias	V	H	1	P/A
EU_F_N001_0.01ba	0.01	EU_F_N001_100	Galium arenarium	V	H	1	P/A
EU_F_N001_0.01bb	0.01	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.1aa	0.1	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.1aa	0.1	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	1	P/A
EU_F_N001_0.1aa	0.1	EU_F_N001_100	Eryngium maritimum	V	H	1	P/A
EU_F_N001_0.1ab	0.1	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	1	P/A
EU_F_N001_0.1ab	0.1	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.1ab	0.1	EU_F_N001_100	Eryngium maritimum	V	H	1	P/A
EU_F_N001_0.1ab	0.1	EU_F_N001_100	Euphorbia paralias	V	H	1	P/A
EU_F_N001_0.1ab	0.1	EU_F_N001_100	Hieracium eriophorum	V	H	1	P/A
EU_F_N001_0.1ba	0.1	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	1	P/A

Appendix 1. Continuation.

GrassPlot.plotID	Area.m2	GrassPlot.ID.largest.nested	Species.original	Group	Layer	Abundance	Abundance_Scale
EU_F_N001_0.1ba	0.1	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.1ba	0.1	EU_F_N001_100	Eryngium maritimum	V	H	1	P/A
EU_F_N001_0.1ba	0.1	EU_F_N001_100	Galium arenarium	V	H	1	P/A
EU_F_N001_0.1bb	0.1	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_0.1bb	0.1	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Calystegia soldanella	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Eryngium maritimum	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Euphorbia paralias	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Galium arenarium	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Hieracium eriophorum	V	H	1	P/A
EU_F_N001_100	100	EU_F_N001_100	Leontodon saxatilis subsp. saxatilis	V	H	1	P/A
EU_F_N001_10a	10	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	5	Cover
EU_F_N001_10a	10	EU_F_N001_100	Calystegia soldanella	V	H	10	Cover
EU_F_N001_10a	10	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	20	Cover
EU_F_N001_10a	10	EU_F_N001_100	Eryngium maritimum	V	H	10	Cover
EU_F_N001_10a	10	EU_F_N001_100	Euphorbia paralias	V	H	2.5	Cover
EU_F_N001_10a	10	EU_F_N001_100	Hieracium eriophorum	V	H	2.5	Cover
EU_F_N001_10b	10	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	5	Cover
EU_F_N001_10b	10	EU_F_N001_100	Calystegia soldanella	V	H	2.5	Cover
EU_F_N001_10b	10	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	10	Cover
EU_F_N001_10b	10	EU_F_N001_100	Eryngium maritimum	V	H	10	Cover
EU_F_N001_10b	10	EU_F_N001_100	Euphorbia paralias	V	H	2.5	Cover
EU_F_N001_10b	10	EU_F_N001_100	Galium arenarium	V	H	5	Cover
EU_F_N001_10b	10	EU_F_N001_100	Hieracium eriophorum	V	H	2.5	Cover

Appendix 1. Continuation.

GrassPlot.plotID	Area.m2	GrassPlot.ID.largest.nested	Species.original	Group	Layer	Abundance	Abundance_Scale
EU_F_N001_10b	10	EU_F_N001_100	Leontodon saxatilis subsp. saxatilis	V	H	2.5	Cover
EU_F_N001_1aa	1	EU_F_N001_100	Calystegia soldanella	V	H	4	Cover
EU_F_N001_1aa	1	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	12	Cover
EU_F_N001_1aa	1	EU_F_N001_100	Eryngium maritimum	V	H	8	Cover
EU_F_N001_1aa	1	EU_F_N001_100	Euphorbia paralias	V	H	8	Cover
EU_F_N001_1aa	1	EU_F_N001_100	Hieracium eriophorum	V	H	1	Cover
EU_F_N001_1ab	1	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	35	Cover
EU_F_N001_1ab	1	EU_F_N001_100	Calystegia soldanella	V	H	6	Cover
EU_F_N001_1ab	1	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	4	Cover
EU_F_N001_1ab	1	EU_F_N001_100	Eryngium maritimum	V	H	4	Cover
EU_F_N001_1ab	1	EU_F_N001_100	Euphorbia paralias	V	H	2	Cover
EU_F_N001_1ab	1	EU_F_N001_100	Hieracium eriophorum	V	H	1	Cover
EU_F_N001_1ba	1	EU_F_N001_100	Ammophila arenaria subsp. australis	V	H	10	Cover
EU_F_N001_1ba	1	EU_F_N001_100	Calystegia soldanella	V	H	6	Cover
EU_F_N001_1ba	1	EU_F_N001_100	Eryngium maritimum	V	H	8	Cover
EU_F_N001_1ba	1	EU_F_N001_100	Galium arenarium	V	H	20	Cover
EU_F_N001_1ba	1	EU_F_N001_100	Leontodon saxatilis subsp. saxatilis	V	H	1	Cover
EU_F_N001_1bb	1	EU_F_N001_100	Calystegia soldanella	V	H	3	Cover
EU_F_N001_1bb	1	EU_F_N001_100	Elytrigia juncea subsp. boreoatlantica	V	H	5	Cover
EU_F_N001_1bb	1	EU_F_N001_100	Eryngium maritimum	V	H	1	Cover
EU_F_N001_1bb	1	EU_F_N001_100	Euphorbia paralias	V	H	3	Cover
EU_F_N001_1bb	1	EU_F_N001_100	Galium arenarium	V	H	0.5	Cover
EU_F_N001_1bb	1	EU_F_N001_100	Hieracium eriophorum	V	H	1	Cover
EU_F_N001_1bb	1	EU_F_N001_100	Leontodon saxatilis subsp. saxatilis	V	H	1	Cover

Appendix 2. Overview of the new datasets in GrassPlot v. 2.00 compared to GrassPlot v. 1.00, including datasets with increased plot numbers (CH_B, with 2,700 additional plots, ES_P, with 3,104 additional plots; UA_F, 115; IR_A, 102; RU_I, 39). See below for quoted references. N_{all} = total number of plots ; N_{ind} = independent plots; N_{nes} = nested-plot series with at least four grain sizes.

Dataset ID	Short dataset name	Country/ies	Province: location	Data owner(s)	Reference(s)	N_{all}	N_{ind}	N_{nes}
EDGG Expeditions/Field Workshops:								
AT_E	EDGG Eastern Alps	Austria	Tyrol, Styria and Carinthia	Martin Magnes, Elías Afif, Christian Berg, Philipp Kirschner, Ermin Mašić, Helmut Mayrhofer	Magnes et al. (2018)	232	52	15
Individually contributed datasets:								
AS_A	Nowak_Kyrgyzstan & Tajikistan	Tajikistan, Kyrgyzstan	Eastern Tajikistan and whole Kyrgyzstan	Arkadiusz Nowak, Ewelina Klichowska, Marcin Nobis, Anna Wróbel		156	12	12
AT_D	Essl, Austria old plots	Austria		Franz Essl		29	29	0
AT_F	Mayer_Obergurgl	Austria	Northern Tyrol: Obergurgl	Roland Mayer, Brigitta Erschbamer	Mayer et al. (2009); Mayer & Erschbamer (2017)	216	108	0
AZ_A	Etzold Caucasus	Azerbaijan	Eastern Greater Caucasus: Shahdag	Jonathan Etzold, Tobias Dahms, Michael Manthey, Jan Peters	Etzold et al. (2016)	1,013	204	204
AZ_B	Peper Gobustan	Azerbaijan	Gobustan region: Gobustan and Jeiranchel	Jan Peper, Michael Manthey	Peper et al. (2010a, b)	1,020	204	204
BE_A	Van Meerbeek_Flanders	Belgium	Flanders	Koenraad Van Meerbeek	Van Meerbeek et al. (2014)	90	90	0
BG_B	BioBio_Bulgaria	Bulgaria	Rhodope Mountains	Idoia Biurrun	Lüscher et al. (2016)	272	68	68
CH_B	Bergamini Switzerland	Switzerland		Ariel Bergamini, Steffen Boch, Klaus Ecker	Bergamini et al. (2013, 2016); Tillé & Ecker (2014); Boch et al. (2018, 2019a, b)	4,779	4,779	0
CH_C	Dengler Wädenswil	Switzerland	Canton of Zürich: Campus Grüental, Wädenswil	Jürgen Dengler, Stefan Widmer	Dengler & Widmer (2018)	227	18	18
CH_D	Dengler_Ausserberg	Switzerland	Valais: Ausserberg	Jürgen Dengler, Manuel Babbi, Regula Billeter, Iwona Dembicz	Dengler et al. (2019)	61	25	3
CH_E	Dengler Alp Glivers	Switzerland	Grisons: Sumvtig-Cumpadinals, Alp Glivers	Jürgen Dengler, Daniel Hepenstrick, Stefan Widmer	Hepenstrick et al. (2018)	39	3	3
CH_F	BioBio_Switzerland	Switzerland	Obwalden: Sarden	Philippe Jeanneret	Lüscher et al. (2016)	260	65	65
CH_G	Meier Switzerland	Switzerland		Eliane Meier	Meier & Hofer (2016)	540	270	0
CN_D	Deng_Mu Us desert	China	Shaanxi: Dingbian, Mu Us Desert	Lei Deng	Deng et al. (2014)	36	36	0
CN_E	Deng_Loess Plataeu	China		Lei Deng	Deng et al. (2016)	330	330	0
CZ_J	Doležal Sumava	Czech Republic	Bohemian Forest Mts., Sumava	Jiří Doležal	Mašková et al. (2009); Doležal et al. (2011)	225	15	15
CZ_K	Doležal_Benesov	Czech Republic	Benesov	Jiří Doležal, Jan Lepš	Lepš et al. (2007)	60	60	0
DE_S	BioBio CSR Germany	Germany	Southern Bavaria: near Ausburgo	Sebastian Wolfrum	Lüscher et al. (2016)	164	41	41
DE_T	Manthey Greifswald	Germany	Western Pomerania: Greifswald	Michael Manthey		913	83	83
ES_P	Alfaro Picos de Europa	Spain	Asturias and Cantabria: Picos de Europa	Borja Jiménez-Alfaro, Alvaro Bueno, Corrado Marcenò	Jímenez-Alfaro et al. (2010)	3,120	16	16

Appendix 2. Continuation.

Dataset ID	Short dataset name	Country/ies	Province: location	Data owner(s)	Reference(s)	N_{all}	N_{ind}	N_{nes}
ES_Q	Löbel Tenerife	Spain	Canary islands, Tenerife: Anaga Mts.	Swantje Löbel, Jürgen Dengler	Löbel & Dengler (2002)	18	13	1
ES_R	de Bello NE Spain	Spain	Catalonia and Aragón: Ebro valley to Pyrenees	Idoia Biurrun	de Bello et al. (2007)	75	15	15
ES_S	Biurrun Urumea	Spain	Basque Country: Urumea stream	Idoia Biurrun	Aramburu (2017)	34	34	0
ES_T	Campos Zalama	Spain	Basque Country: Zalama Mt.	Juan Antonio Campos, Idoia Biurrun		24	24	0
ES_U	Pladevall Pyrenean fens	Spain	Catalonia: Pyrenees	Eulàlia Pladevall-Izard, Aaron Pérez-Haase		859	859	0
EU_E	Roleček Hungary-Romania	Hungary, Romania	Mátra Mts., Bükk Mts., Transylvania, Cluj	Jan Roleček, Pavel Dřevojan, Michal Hájek	Roleček et al. (2019)	5	5	0
EU_J	Janišová Carpathians	Romania, Slovakia	Carpathians: Borišov, Veľká Fatra Mts; Ciosa, Caliman Mts; Poiana Fagului, Hargita	Monika Janišová, Martin Magnes		204	17	17
EU_K	Essl Europe	Austria, Belarus, Bosnia, Croatia, Germany, Ireland, Italy, Serbia		Franz Essl		766	239	159
EU_L	Perez Haase_Pyrenean mires	Spain, Andorra	Pyrenees	Aaron Pérez-Haase, Josep Maria Ninot		376	376	0
FR_B	Van Mechelen_Languedoc	France	Languedoc-Roussillon, Provence-Alpes-Côte d'Azur	Carmen Van Mechelen	Van Mechelen et al. (2014)	253	253	0
HU_F	BioBio_Hungary	Hungary	Homokhátság	Idoia Biurrun	Lüscher et al. (2016)	316	79	79
HU_G	Bátori Hungarian dolines	Hungary	N Hungarian mountains: Aggtelek Karst and Bükk Mts.	Zoltán Bátori, Tünde Farkas, András Vojtkó	Bátori et al. (2017)	356	356	0
IN_A	Doležal Ladakh unpublished	India	Jammu & Kashmir: East Ladakh, SW Tibetan Plateau	Jiří Doležal		369	369	0
IN_B	Doležal Ladakh nested	India	Jammu & Kashmir: East Ladakh, SW Tibetan Plateau	Jiří Doležal	Dvorský et al. (2011)	384	192	0
IR_A	Naqinezhad Central Alborz	Iran	Alborz Mts.: Central Alborz, Damavand	Alireza Naqinezhad, Amir Talebi	Talebi (2019)	459	27	27
IT_Q	EGC Sulmona	Italy	Chieti province: Palena: San Nicola	Giampiero Ciaschetti, Sabina Barruscano	Burrascano et al. (2018)	13	1	1
IT_R	Filibeck_Picinisco	Italy	Central Apennines, Picinisco	Goffredo Filibeck, Laura Cancellieri		83	83	0
KZ_A	Deak Kazhkstan	Kazakhstan	Kostanay oblast: Rudny, Karamendi, Alexandrovskaya	Orsolya Valkó, Zoltán Bátori, Balázs Deák, András Kelemen, Csaba Tölgyesi	Deák et al. (2017)	200	200	0
NO_C	Grytnes North Norway	Norway	Troms: Dividalen	John-Arvid Grytnes		231	33	33
NO_D	Grytnes South Norway	Norway	Sogn og Fjordane: Lærdal	John-Arvid Grytnes		70	10	10
NO_E	Landscape Monitoring Norway	Norway		Wenche Dramstad, Wendy Fjellstad, Jutta Kapfer, Christian Pedersen, Hanne Sickel, Grete Stokstad		2,276	569	569
NP_A	Bhatta Nepal	Nepal	Langtang National Park	Kuber Prasad Bhatta, John-Arvid Grytnes, Ole Reidar Vetaas	Bhatta et al. (2018a, b)	252	126	0

Appendix 2. Continuation.

Dataset ID	Short dataset name	Country/ies	Province: location	Data owner(s)	Reference(s)	N_{all}	N_{ind}	N_{nes}
PL_D	Pielech nested	Poland	SW Poland: Karkonosze Mts.	Remigiusz Pielech, Marek Malicki		130	10	10
PL_E	Kozub Biebrza	Poland	Podlaskie	Łukasz Kozub, Iwona Dembicz, Katarzyna Skłodowska		195	15	15
PT_A	Lomba_Ecochange	Portugal	Viana do Castelo: Castro Laboreiro	Ângela Lomba, João Honrado		24	24	0
RO_D	Csergó_Transylvania	Romania	SE Carpathians: Somlyó Valley (Csík Basin) and Kolos (Csík Mountains)	Anna Mária Csergő, László Demeter	Csergő & Demeter (2012); Csergő et al. (2013); Maseyk et al. (2017)	196	196	0
RU_I	Belonovskaya Novgorodskaya	Russia	Novgorodskaya oblast: Valday hills	Elena Belonovskaya, Nadezda Tsarevskaya	Belonovksaya & Tsarevskaya (2018)	49	7	4
RU_K	Mirin Belogorie	Russia	Belgorod region: reserve Belogorie	Denis Mirin, Ekaterina Zlotnikova		26	2	2
RU_L	Dolnik South Ural	Russia	Orenburg and Chelyabinsk regions	Christian Dolnik		91	7	7
RU_M	Doležal Kamchatka	Russia	Kamchatka: Koryto Glacier Valley	Jiří Doležal		80	10	10
SE_E	Alatalo Subarctic Sweden	Sweden	Norbotten: Latnjajaure	Juha M. Alatalo, Annika Jägerbrand, Ulf Molau	Alatalo et al. (2014 a, b; 2015a, b; 2016; 2017)	20	20	0
SE_F	Waldén Sweden restoration	Sweden	SE Sweden	Emelie Waldén, Regina Lindborg	Waldén & Lindborg (2016)	50	50	0
TJ_A	Nowak_Tajikistan	Tajikistan	Western Tajikistan	Arkadiusz Nowak, Iwona Dembicz, Zygmunt Kącki, Grzegorz Swacha, Sebastian Świerszcz		195	15	15
TR_B	Güler Buca İzmir	Turkey	İzmir	Behlül Güler		50	14	3
UA_F	Vasheniak Dniester Canyon	Ukraine	Dniester Canyon and tributaries	Iuliia Vashenyak	Vasheniak (2018)	329	329	0
UA_H	Kuzemko Byzky Gard	Ukraine	Mykolaiv: Buzky Gard NNP	Anna Kuzemko, Ganna Kolomients, Dariia Shyriaieva		26	2	2
UA_I	Kuzemko Kreida	Ukraine	Kharkiv: Oskol River and Vovcha River valleys	Anna Kuzemko, Olga Bezrodnova, Vladimir Ronkin, Galina Savchenko		104	8	8
UA_J	Vynokurov Southern Ukraine	Ukraine	Southern Ukraine	Denys Vynokurov, Ivan Y. Moysiyenko, Dariia Shyriaieva		242	110	11
UA_K	Savchenko Kharkiv & Donetsk	Ukraine	Kharkiv and Donetsk regions	Galina Savchenko, Vladimir Ronkin		143	11	11
UA_L	Dembicz nested Ukraine	Ukraine	Kherson region	Iwona Dembicz, Łukasz Kozub, Ivan Y. Moysiyenko, Viktor Shapoval		156	12	12
UK_C	BioBio_United Kingdom	United Kingdom	Wales	Idoia Biurrun	Lüscher et al. (2016)	432	108	108
UK_D	Stevens Sheffield acidic	United Kingdom	England: Sheffield	Carly Stevens	Stevens et al. (2016)	196	196	0
UK_E	Stevens Sheffield calcareous	United Kingdom	England: Sheffield	Carly Stevens	Stevens et al. (2016)	242	242	0

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Photo Story

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Cultural landscapes of the Lower Engadine, Switzerland

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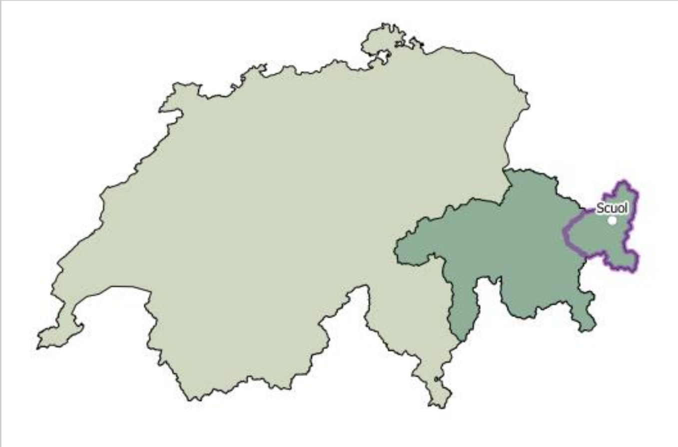
Engadine is the name for the part of the Inn valley located in SE Switzerland, in the canton of Grisons. The valley bottom ranges from the Maloja pass at 1,815 m a.s.l. down to the Austrian border at 1,035 m a.s.l. The Lower Engadine is the section of the Engadine between Zernez and Martina, where the Inn, compared to the flat valley bottom of the Upper Engadine, is deeply carved into the terrain. On the one hand, the Lower Engadine is characterised by high mountains, Piz Linard at 3,410 m a.s.l. being the highest. Here are remote and largely untouched alpine landscapes such as those of the Swiss National Park, founded in 1914 and thus being one of the oldest in Europe and the only one in Switzerland. On the other hand, the cultural landscapes below the alpine belt here are still quite diverse and better preserved than in most other parts of Switzerland and Europe.

There are various reasons for the maintenance of structurally rich and biodiverse landscapes just here. Steep slopes have prevented, so far, strong intensification while the high Swiss agricultural subsidies ensure that most of the former grasslands are still managed as meadows and pastures. Compared to other places in Switzerland, the nitrogen input from the atmosphere is very low. Mass tourism has damaged many other parts of the Alps considerably but the Lower Engadine is only accessible by a relatively small road and, from the Swiss side, by railway, so mass tourism did not develop here to such a great extent. Moreover, the biodiversity of the Lower Engadine is enhanced by a diverse geology and steep south-facing slopes with a slightly continental climate, which supported the development of a rich xerothermic vegetation with its associated fauna. Agriculture is nearly exclusively animal-based, i.e. using meadows and pastures to feed cattle and other livestock. The grasslands below the alpine zone are semi-natural in the majority, with the exception of small areas around rocky outcrops and on steep rocky slopes, which might be free of forest naturally. While the grasslands of the Lower Engadine have not remained untouched by the two main threats to European grasslands, i.e. intensification and abandonment, they are still in a comparatively good state and an attractive place for grassland ecologists to visit and survey.

Further reading

Braun-Blanquet, J. 1961. *Die inneralpine Trockenvegetation*. Fischer, Stuttgart, DE: 273 pp.

Zoller, H. 1995. *Vegetationskarte des Schweizerischen Nationalparks – Erläuterungen*. Flück-Wirth [Nationalpark-Forschung in der Schweiz No. 85], Zernez, CH: 108 pp. + map.



Location of the administrative district of Engiadina Bassa (Lower Engadine)/Val Müstair Region (marked with violet framing) in Switzerland, and in the canton of Grisons (darker green colour).

In the Lower Engadine, the villages like Vnà (pictured), are situated on the sunny terraces typically several hundred meters above the river.

The Engadine takes its name from the river Inn (Romansh: En).

The richly structured cultural landscapes of the Lower Engadine, apart from grasslands, contains hedgerows, single trees and alleys, terraces and road verges, outcrops, stone heaps and stone walls. Thus the landscape is a diverse mosaic, full of colours throughout the seasons.

The grasslands are managed as pastures and meadows to feed mainly cattle, while other land uses such as beekeeping are also present. Maintenance of the traditional meadows on the steep slopes is challenging under present-day conditions and depends on subsidies: the scythe is meanwhile replaced by expensive high-tech machinery that allows mowing of even the steepest slopes. A championship for the best meadows rewards those farmers who maintain the most diverse meadows, while at the same time raising public awareness about the importance of species-rich grasslands.

Grassland types range from rocky outcrops, through steppic grasslands, semi-dry and mesic to wet grasslands. The picture to the left shows a steppic grassland with *Hieracium umbellatum*, the picture to the right a semi-dry grassland with *Salvia pratensis*, *Echium vulgare*, *Centaurea scabiosa* and *Trifolium montanum*.



Typical vascular plants of the semi-dry grasslands: *Cirsium eriophorum*, *Onobrychis viciifolia* and *Centaurea scabiosa* (from left to right).


The hedgerows and shrub patches harbour colourful fruits in autumn, here *Berberis vulgaris* (left) and *Rosa villosa* (right).


Particularly on and around rocky outcrops, the lichen and bryophyte flora can be rich: cryptogam community with *Hedwigia ciliata* agg. (left), *Rhytidium rugosum* (right).

The semi-natural grasslands, particularly the dry grasslands, also harbour a rich fauna: *Polyommatus icarus* (upper left), *Arcyptera fusca* (upper right) and a jumping spider, possibly a female of *Aelurillus v-insignitus* (lower left); and this diversity is reflected in the typical wall decorations on the Engadine houses, called *sgraffito*.

The fact that the Engadine was formerly an important traffic road over the Alps is reflected by many castles and fortified towers, which are now mostly ruins, like Ardez (upper right). Apart from *sgraffiti*, the Engadine houses are also decorated with paintings and flowers.

Short Contributions

Insect decline is most dramatic in grasslands in the vicinity of intensively farmed croplands

Compared to a decade ago the number of insect species within many grassland areas has decreased by approximately one third

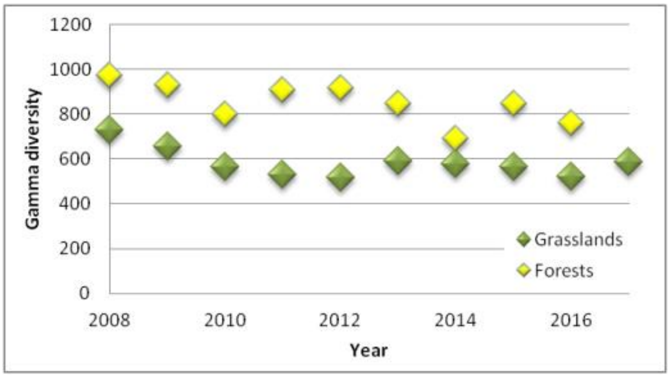


Fig. 1. Gamma diversity (total number of species per habitat per year across all plots) change in two habitats (confidence intervals not shown).

Various studies have reported a decline in insects over the last decades. A long-term study within protected areas in Germany attracted global interest when it reported a greater than 75% decline in insect biomass over 27 years (Hallmann et al. 2017). A review by Sánchez-Bayo & Wyckhuys (2019) initiated a series of discussions amongst scientists on the generalization of results from single studies to a global scale. As most studies have focused either exclusively on biomass, certain species groups, or particular sites, it has been unclear if the decline can be generalized to many insect groups.

A recent study published in the journal *Nature* at the end of October by Seibold et al. (2019) reported a dramatic decline in several insect groups within grasslands and forests in Germany over a 10 year period (Fig. 1). The decline was most severe in grasslands neighbouring intensively-managed croplands.

A multinational team of 19 researchers conducted the study as a part of the Biodiversity Exploratories Project funded by Deutsche Forschungsgemeinschaft. The arthropod team collected more than one million insects at 290 sites in Brandenburg, Thuringia and Baden-Württemberg between 2008 and 2017. The number of individuals was determined for 22 arthropod orders and specimens from four orders (Araneae, Orthoptera, Coleoptera and Hemiptera) were identified to species level (except the latter two orders for forest specimens). The results showed that many of the nearly 2700 investigated species were in decline (Fig. 2).

Fig. 2. Left: Populations of insect species, such as the Small Gold Grasshopper (*Chrysochraon dispar*), have declined (Photo: M. Fellendorf). Right: The sloe bug (*Dolycoris baccarum*) is one of the few species that have barely declined (Photo: S. Seibold).

Fig. 3. Left: Meadows in the vicinity of intensively farmed areas suffer from insect species loss, such as this meadow in Schorfheide (Photo: U. Garbe). Right: Insect decline also occurs at sites managed at lower intensities, such as this sheep pasture in Schwäbische Alb only grazed few days a year (Photo: J. Hailer).

In grasslands, biomass, abundance and number of species declined by 67%, 78% and 34%, respectively. The decline was consistent across trophic levels and mainly affected rare species; and its magnitude was independent of local land-use intensity but closely related to land-use intensity in the surrounding croplands. The biggest losses were in grasslands surrounded by intensively farmed land, where the most heavily impacted species were poor dispersers i.e. those unable to travel far (Fig. 3, left). In forests, biomass and species number, but not abundance, decreased by 41% and 36%, respectively. The decline affected rare and abundant species and trends differed across trophic levels. In the forested areas the most impacted insect groups were those that cover longer distances. Further studies are needed to disentangle the relationship between the diversity of species with different dispersal abilities, their habitats, and the surrounding landscape.

Every type of forest and grassland site studied by the team was impacted, these included sheep pastures (Fig. 3, right), meadows that were mown and fertilized three to four times per year, forests dominated by planted coniferous trees, and even unmanaged forests in protected areas. Such a steep decline in insect biodiversity over 10 years is alarming but consistent with the results presented in a growing number of studies. To halt the decline a paradigm shift in land-use policy is required. Instead of implementing independent and isolated site-level conservation actions, measures to improve the habitat quality for insects needs to be implemented and coordinated across landscapes and regions and mainstreamed across all sectors involved in natural resource use in terrestrial ecosystems.

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Seibold, S., Gossner, M.M., Simons, N.K., Blüthgen, N., Müller, J., Ambarlı, D., Ammer, C., Bauhus, J., Fischer, M., (...) & Weisser, W.W. 2019. Arthropod decline in grasslands and forests is associated with drivers at landscape level. *Nature* 574: 671-674. https://doi.org/10.1038/s41586-019-1684-3.

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Please, help us with your photos!

Research to understand the cultural value of permanent grasslands

The EU Horizon 2020 **SUPER-*G*** project is running a **'Photo Competition'** with a chance to win a trip to Bled, Slovenia and the Triglav National Park on 17-18 June 2020. We hope the competition will help us better understand how grasslands are valued by society.

Permanent grasslands deliver multiple public goods and services such as forage for grazing animals, resources for pollinators, carbon sequestration for mitigating greenhouse gas emissions, water regulation, and protection against erosion. Grasslands also support different types of cultural services, e.g. recreational opportunities, local identity, cultural heritage, as well as aesthetic values (Potschin & Haines-Young 2011). However, permanent grasslands are threatened in quantity and quality for diverse reasons. Intensification, conversion to temporary grassland or arable land, afforestation, heat and drought stress are only some examples.

The **SUPER-*G*** (Developing SUstainable PERmanent Grassland systems and policies) project, which is funded by the EU H2020 program, aims to assess and co-develop sustainable grassland systems and policies in cooperation with farmers and policy makers. Thus, a major aim of the project is to establish fruitful cooperation between scientists and stakeholders.

In this project, we want to study the cultural services provided by permanent grasslands, such as those connected to biodiversity, aesthetic value, cultural heritage and recreational use. We are also interested in people's perception of the economic activities that are carried out on grasslands, as well as the perception of the threats to which permanent grasslands are exposed. A relatively new and very promising method for gathering information is photo series analysis, a non-participatory and spatial explicit method involving contributors without their active participation (e.g. Casalegno et al. 2013; Richards & Friess 2015). As this method requires many photos well distributed across Europe, we launched the "**SUPER-*G* Photo Competition**" on European permanent grasslands.

Photos as examples of the photo competition topics: a) Flower-rich meadow in Switzerland; b) Goats on dry grassland in Germany; c) School kids and cows in Switzerland. Photos: V.H. Klaus. d) Flowering meadows from Slovenia. Photo: F. Šivic.

We are looking for photos connected to permanent grasslands such as meadows, pastures or any other grassland types that contain information on the following topics:

1. Wildlife and biodiversity,
2. Cultural values of the grasslands,
3. Farmlands, outdoor farming activities,
4. Outdoor recreation in grasslands,
5. Risks and threats on grasslands.

The authors of the three winning photographs will be invited to a place where wonderful grasslands can be found: the city of Bled, in Slovenia in June 2020, and the wonderful Triglav National Park!

To participate in our photo competition, please, go to

www.super-g.eu/2019-photo-competition

For more information write to Eszter Lellei-Kovács: lke.photos.super-g@okologia.mta.hu

Project website: www.super-g.eu

Deadline: 31 January 2020

Evaluation will be conducted by a board of the **SUPER-*G*** project.

We look forward to receiving your photos!

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Casalegno, S., Inger, R., DeSilvey, C. & Gaston, K.J. 2013. Spatial Covariance between Aesthetic Value & Other Ecosystem Services. *PLOS One* 8: e68437.

Potschin, M.B. & Haines-Young, R.H. 2011. Ecosystem services: Exploring a geographical perspective. *Progress in Physical Geography* 35: 575–594.

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Corrigendum to Pachlatko J., Wyttenbach M., & Dengler J. "Alpine grassland vegetation at Gornergrat (Canton of Valais, Switzerland): Vegetation mapping for environmental planning"

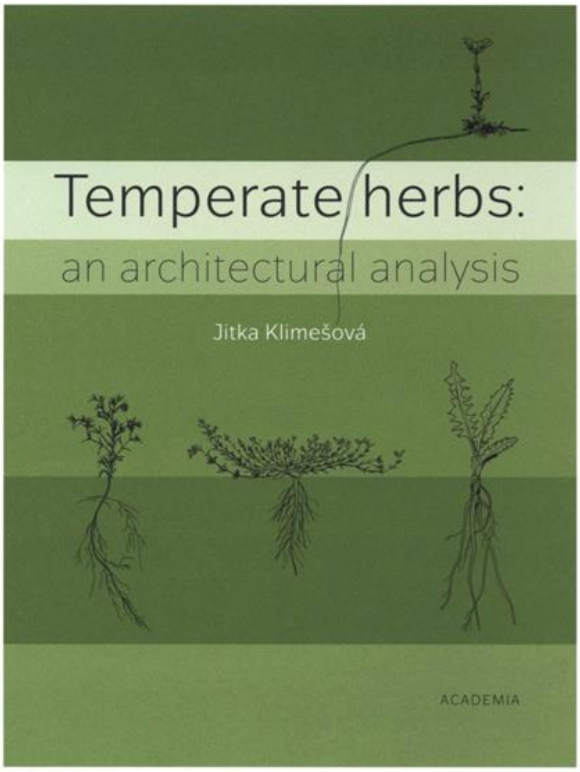
In the article of Pachlatko et al. (2019, *Palaearctic Grasslands*, 43, 23-37), unfortunately an error has been published. In the caption of Fig. 15 on page 36, it should read *Aster alpinus* instead of *Erigeron alpinus*.

Male Alpine ibex (*Capra ibex*) resting in an alpine grassland, Grisons, Switzerland. Photo: J. Dengler.

Book Review

DOI: 10.21570/EDGG.PG.44.58-58

Klimešová, J. 2018. Temperate herbs: an architectural analysis. Praha: Academia, 274 pp., ISBN: 978-80-200-2760-3 (Hardcover: 520 CZK, ~ 20 €).



Functional analysis of plant communities based on plant morphology is deeply rooted in the history of botany and plant ecology. The pioneering work of plant ecology by Warming (*Plantesamefund*, 1895, translated and reworked in German as *Lehrbuch der Ökologischen Pflanzengeographie* co-authored by P. Gräbner, 1896) listed several growth forms of plants, which formed a basis for the life-form classification of Raunkiaer (1934). The Raunkiaer life-forms are widely cited and still used today. Most approaches to study the functioning of plant communities frequently just consider aboveground traits and interactions, however the understanding of belowground processes in plant interactions and coexistence is gaining increasing attention (Vos & Kazan 2016; Li et al. 2017).

In the age of trait-based ecology, much analytical information related to plant architecture e.g., plant growth forms, morphology and traits of plant organs is used in research, but a unified classification of angiosperms based on plant architecture are still lacking. The comprehensive book of Klimešová (2018) is one of the first attempts to fill this gap; the author aimed to (i) provide a brief synthesis of architectural classification universal for all growth forms, (ii) to summarise architectural categories relevant for herbs in the temperate region and to (iii) introduce these categories by using examples from Central Europe. The book has a very compact 17-page intro followed by a part containing 1614 line drawings of 706 herb species in more than 200 pages. The drawings of the book were based on a more than twenty years of field research by the author and co-workers and formed the basis of the CLO-PLA database (https://clopla.butbn.cas.cz/). As the CLO-PLA database is used frequently in trait-based analyses, this book helps to visualise the clonal and bud-bank trait categories used in the database. The book covers the most important taxa and most all genera of Central Europe and it is easy to use. The drawings are of high quality and the book is designed in an attractive, minimalist style. All in all, the book provides a very useful and comprehensive basis for researchers who would like to get familiar with the architecture of plants and belowground-trait ecology.

Raunkiaer, C. 1934. *The life forms of plants and statistical plant geography.* Oxford University Press, London.

Vos, C.M.F. & Kazan, K. (eds.) 2016. *Belowground defence strategies in plants.* Springer International Publishing, CH.

Li, H., Liu, B., Ma, Z. & Guo, D. 2017. Diverse belowground resource strategies underlie plant species coexistence and spatial distribution in three grasslands along a precipitation gradient. *New Phytologist* 216: 1140-1150.

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Forthcoming Events

14th annual meeting of the specialist group Macroecology of the Ecological Society of Germany, Austria, and Switzerland: "Macroecology of the Anthropocene"
2 – 5 March 2020, Konstanz, Germany
Conference website: https://www.biologie.uni-konstanz.de/kleunen/macro-2020/

The International Biogeography Society Early Career Conference
17-19 April 2020 in Amsterdam, the Netherlands
Conference website: https://www.biogeography.org/event/early-career-conference-amsterdam/

29th European Vegetation Survey Meeting
4-7 May 2020, Rome, Italy
Conference website: http://evs2020roma.info

9th PLANTA EUROPA Conference
11-15 May 2020, Paris, France
Conference website: https://www.plantaeuropa.com/planta-europa-conference-2020

14th EDGG Field Workshop: Ukrainian steppes along climatic gradients
25 May – 3rd June 2020, Ukraine
See details in this issue, on pp. 6-15.

10th International Conference on Serpentine Ecology (ICSE 10)
21-30 June 2020, Ekaterinburg, Russia
Conference website: http://icse10.urfu.ru

28th General Meeting of the European Grassland Federation
22–25 June 2020 in Helsinki, Finland
Conference website: www.egf2020.fi

2nd Quarries alive International Conference
24-26 June 2020, Liege, Belgium
Conference website: http://www.gembloux.ulg.ac.be/qa2020/

63rd IAVS Symposium: Vegetation in the Anthropocene
20-24 July 2020, Vladivostok, Russia
Symposium website: http://geobotanica.ru/symposium_2020/

12th European Conference on Ecological Restoration SER 2020
31 August – 4 September 2020, Alicante, Spain
Conference website: https://chapter.ser.org/europe/event/alicante-spain-ser-europe-conference/

17th Eurasian Grassland Conference: Grassland dynamics and conservation in a changing world
7–13 September 2020, Tolosa, Spain
See details in *Palaearctic Grasslands* 43: 8-13.

***Spiranthes spiralis* in Alta Murgia National Park, Puglia, Italy. Photo: R. Labadessa.**

EDGG on the web:
http://www.edgg.org

EDGG in Facebook:
https://www.facebook.com/groups/938367279561202

EDGG on the ResearchGate
https://www.researchgate.net/project/EDGG-Eurasian-DryGrassland-Group

The Eurasian Dry Grassland Group (EDGG), founded in 2008, is a working group of the International Association for Vegetation Science (IAVS) and member of the European Forum on Nature Conservation and Pastoralism (EFNCP). On 20 December 2019, it had 1326 members from 63 countries.

The **Eurasian Dry Grassland Group (EDGG)** is a network of researchers and conservationists interested in any type of Palaearctic natural and semi-natural grasslands. It is an official subgroup of IAVS (http://www.iavs.org) but one can join our group without being an IAVS member. We live from the activities of our members. Everybody can join the EDGG without any fee or other obligation.

The EDGG covers all aspects related to grasslands, in particular: plants - animals - fungi - microbia - soils - taxonomy - phylogeography - ecophysiology - population biology - species' interactions - vegetation ecology - syntaxonomy - landscape ecology - biodiversity - land use history - agriculture - nature conservation - restoration - environmental legislation - environmental education.

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Red nymphs of *Canthophorus melanopterus* on *Osyris alba*, Bari, Italy. Photo: R. Labadessa.