Scientific Report

DOI: 10.21570/EDGG.PG.45.34-58

On the trails of Josias Braun-Blanquet – changes in the grasslands of the inneralpine dry valleys during the last 70 years. First results from the 11th EDGG Field Workshop in Austria

Martin Magnes[1*], Philipp Kirschner[2], Monika Janišová[3], Helmut Mayrhofer[1], Christian Berg[1], Amparo Mora[4], Elias Afif[5], Wolfgang Willner[6], Elena Belonovskaya[7], Asun Berastegi[8], Laura Cancellieri[9], Itziar García-Mijangos[10], Riccardo Guarino[11], Anna Kuzemko[12,13], Ermin Mašić[14], Harald Rötzer[15], Milica Stanišić[16], Denys Vynokurov[12,13], Iwona Dembicz[17,18], Idoia Biurrun[10] & Jürgen Dengler[18,19,20]

[1]Division of Plant Sciences, Institute of Biology, Karl-Franzens-University of Graz, Holteigasse 6, 8010 Graz, Austria; martin.magnes@uni-graz.at; helmut.mayrhofer@uni-graz.at; christian.berg@uni-graz.at

[2]Naturpark Kaunergrat (Pitztal – Fließ – Kaunertal), Gachenblick 100, 6521 Fließ, Austria; philipp.kirschner@gmail.com

[3]Institute of Botany, Plant Science and Biodiversity Centre, Slovak Academy of Sciences, Ďumbierska 1, 974 11 Banská Bystrica, Slovak Republic; monika.janisova@gmail.com

[4]Área Conservación Parque Nacional Picos de Europa, Av. Covadonga 43, 33550 Cangas de Onis, Spain; amora@pnpeu.es

[5]Department of Organisms and Systems Biology, Polytechnic School of Mieres, Oviedo University, C/Gonzalo Gutiérrez de Quirós s/n, 33600 Mieres, Spain; elias@uniovi.es

[6]Department of Botany and Biodiversity Research, University of Vienna, Rennweg 14, 1030 Vienna, Austria; wolfgang.willner@univie.ac.at

[7]Department of Biogeography, Institute of Geography, Russian Academy of Sciences, Staromonetny per. 29, 119017 Moscow, Russia; ebelonovskaya.0709@gmail.com

[8]Department of Biodiversity, Gestión Ambiental de Navarra, S.A., Padre Adoain 219 Bajo, 31015 Pamplona, Spain; aberastg@gan-nik.es

[9]Department of Agriculture and Forestry Science, University of Tuscia, 01100 Viterbo, Italy; cancellieri@unitus.it

[10]Department of Plant Biology and Ecology, University of the Basque Country UPV/EHU, P.O. Box 644, 48080 Bilbao, Spain; itziar.garcia@ehu.es; idoia.biurrun@ehu.es

[11]Department STEBICEF – Botanical Unit, University of Palermo, via Archirafi, 38, 90123 Palermo, Italy; riccardo.guarino@unipa.it

[12]Geobotany and Ecology Department, M.G. Kholodny Institute of Botany NAS of Ukraine, Tereshchenkivska str. 2, 01601 Kyiv, Ukraine; anyameadow.ak@gmail.com; denys.vynokurov@gmail.com

[13]Department of Botany and Zoology, Masaryk University, Kamenice 753/5, 625 00 Brno, Czech Republic

[14]Prirodno-Matematički Fakultet, Univerzitet u Sarajevu, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia-Herzegovina; erminmasic@hotmail.com

[15]AVL Agency for Vegetation Ecology and Landscape Planning, Theobaldgasse 16/4, 1060 Vienna, Austria; harald.roetzer@a-v-l.at

[16]Faculty of Natural Sciences and Mathematics, University of Montenegro, Džordža Vašingtona bb, 81 000 Podgorica, Montenegro; stanisic.milica90@gmail.com

[17]Polish Academy of Sciences, ul. Prawdziwka 2, 02-973 Warszawa, Poland; i.dembicz@gmail.com

[18]Vegetation Ecology, Institute of Natural Resource Sciences (IUNR), Zurich University of Applied Sciences (ZHAW), Grüentalstr. 14, 8820 Wädenswil, Switzerland; juergen.dengler@uni-bayreuth.de

[19]Plant Ecology, Bayreuth Center of Ecology and Environmental Research (BayCEER), Universitätsstr. 30, 95447 Bayreuth, Germany

[20]German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Deutscher Platz 5e, 04103 Leipzig, Germany

*) corresponding author

Palaearctic Grasslands 45 (2020): 34-58

Abstract: The 11th EDGG Field Workshop was held from 6 to 13 July 2018 in Austria. Its aim was to revisit dry grasslands in the inneralpine dry valleys of Austria that were investigated in the late 1950s by Braun-Blanquet and to collect high-quality biodiversity data from these. Sampling was carried out in the Styrian Mur Valley, the Virgen Valley in East Tyrol, the Upper Inn Valley in the Austrian Eastern Alps, and Griffen in Carinthia. In total, we sampled 15 EDGG biodiversity plots and 37 additional 10 m² plots. Butterfly data were recorded in four biodiversity plots and two additional plots. We found maximum richness values of 49, 68 and 95 vascular plant species on 1, 10 and 100 m², while the corresponding values for the complete terrestrial vegetation were 56, 73 and 106 species. Maximum butterfly richness was 19, but it was in general quite low, and generalists dominated. Some of the areas originally studied by Braun-Blanquet were no longer dry grasslands and only a few sites remained largely unchanged. Detrended Correspondence Analysis (DCA) showed profound changes between the old (1950s and 1980s) and our current plots. Without grazing or other human land management activities, only very small cores of rocky dry grassland could survive in the comparatively humid Austrian inneralpine valleys. Finally, the sampled data raise questions about the syntaxonomic position of some of the grasslands, which needs to be addressed in a more comprehensive study, which is planned as the next step.

Keywords: Austria; biodiversity; bryophyte; butterfly; dry grassland; Eurasian Dry Grassland Group (EDGG); inneralpine dry valley; lichen; nested plot; species richness; syntaxonomy; vascular plant.

Nomenclature: Names of vascular plants, bryophytes and lichens are according to the Austrian species list of Turboveg (January 2019), mostly based on Fischer et al. (2008), Frahm & Frey (2004) and Nimis et al. (2018), respectively. Names of butterflies follow Wiemers et al. (2018).

Abbreviations: DCA = Detrended Correspondence Analysis; EDGG = Eurasian Dry Grassland Group; EIV = Ellenberg Indicator Value; EIV_C: EIV for continentality; EIV_N: EIV for nutrients; EIV_M: EIV for moisture; EIV_R: EIV for soil reaction; EIV_T: EIV for temperature; EIV_L: EIV for light.

Submitted: 3 December 2019; first decision: 24 December 2019; accepted: 16 January 2020

Scientific Editor: Alla Aleksanyan

Linguistic Editors: Magdalena Firganek-Fulcher & Tim Fulcher

Introduction

Since 2009, the Eurasian Dry Grassland Group (EDGG) has carried out 13 Field Workshops for collecting high-quality biodiversity and compositional data of grassland vegetation in under-sampled parts of the Palaearctic (Dengler et al. 2016a; Dengler et al. 2019). Despite the main goal of EDGG Field Workshops being to collect data on vascular plants, bryophytes and lichens, specialists in other taxonomic groups are encouraged to participate. Data collected during these expeditions have already been used for a series of regional studies on phytosociological classification (Dengler et al. 2012; Pedashenko et al. 2013; Kuzemko et al. 2014) and patterns and drivers of plant diversity (Turtureanu et al. 2014; Kuzemko et al. 2016; Polyakova et al. 2016) as well as for a comparative overview on mean and maximum richness values of Palaearctic grasslands (Dengler et al. 2016b). To facilitate the broad scientific utilization of the multi-scale vegetation plot data from EDGG Field Workshops, these are fed into the "GrassPlot" database of EDGG (Dengler et al. 2018; Biurrun et al. 2019), which is used for several projects dealing with alpha and beta diversity, such as the recently published overarching study on species-area relationships in Palaearctic grasslands (Dengler et al. 2020b).

Here we report on the 11th EDGG Field Workshop in the inneralpine valleys of Austria, held from 6 to 13 July 2018, and present some initial findings. This event was organized by Martin Magnes, Helmut Mayrhofer (both Institute of Biology, University of Graz) and Philipp Kirschner (Institute of Botany, University of Innsbruck, and Nature Park Kaunergrat). The main aims were (i) to collect multi-scale and multi-taxon biodiversity data from the dry grasslands in the region, (ii) to examine the present state of the Austrian sites Braun-Blanquet had sampled in the 1950s, and (iii) to resolve the position of the stands in the current syntaxonomic system.

The 11th EDGG Field Workshop

In the Field Workshop, 19 scientists from 10 European countries (Austria, Bosnia-Herzegovina, Italy, Montenegro, Poland, Russia, Slovakia, Spain, Switzerland and Ukraine) participated, mostly botanists, but also one zoologist specialized in butterflies (A. Mora) (Fig. 1). After the field work, additionally C. Berg was involved with bryophyte determination and E. Afif with soil analyses.

Based on pre-excursions, only three Austrian regions investigated by Braun-Blanquet (1961) were appropriate for a detailed re-investigation with a big group: the middle section of the Mur Valley in Styria (the most eastern part of the inneralpine dry valleys in the sense of Braun-Blanquet), the Virgen Valley in East Tyrol and the Upper Inn Valley south east of Landeck (Fig. 2). The three regions are positioned along a gradient of continentality: the most continental Upper Inn Valley near the centre of the biggest mountain mass of the Alps is followed by the Styrian Mur Valley near the eastern border of the Alps and, between them, the Virgen Valley in East Tyrol with climatic influences from the Mediterranean (see Magnes et al. 2018). An additional half-day sampling took place in Carinthia, on the castle hill of Griffen, as Braun-Blanquet (1961) also worked on this location, which lay on our way back to Graz. During eight days, we collected data in 15 EDGG biodiversity plots (nested-plot series) and 37 additional 10 m^2 plots. They are distributed from 47.00566 to 47.70428° N, from 10.60588 to 14.92244° E and from 549 to 1,955 m a.s.l. (Fig. 2).

The four study regions in detail

Mur Valley in Styria

Braun-Blanquet (1961) identified the upper part of the Styrian Mur Valley as the easternmost extension of the inneralpine dry valleys. The nearest climatogenic dry grasslands can be found on the eastern foothills of the Eastern Alps, approximately 130 km northeast, already influenced by the continental climate of the Pannonian Basin (Magnes 2018a; Magnes et al. 2018). The first destination of our field workshop was the famous Gulsen near Kraubath, the largest serpentinite outcrop of Central Europe (Brooks 1987).

Besides some typical dry grassland species, like *Silene otites*, which occurs nowhere else in Styria, we saw also the palaeoendemic *Sempervivum pittonii* in full flower (Fig. 3), *Notholaena marantae* (Fig. 4), in Central Europe only known from serpentinite, and the rare liverwort *Mannia fragrans*. Although grazing by goats ceased before the 1950s (Fig. 5) and part of the former dry grasslands are now *Pinus sylvestris* forest or forest steppes, the very steep southern slopes of Gulsen, near the quarry, still host the only primarily climate induced Styrian dry grasslands (Magnes 2018b) - we were unable to visit them unfortunately.

Other targets in the Mur Valley region were Oberkurzheim near Pöls, in a tributary valley of the Mur upstream from Gulsen, the Puxerloch north of Teufenbach and shortly re-established grasslands around a siliceous rock near Neumarkt. Pöls is the only known site of *Stipa styriaca* (Fig. 6),

Fig. 1. The group at the Gottschaunalm (1,934 m a.s.l.), East Tyrol. Photo: J. Dengler.

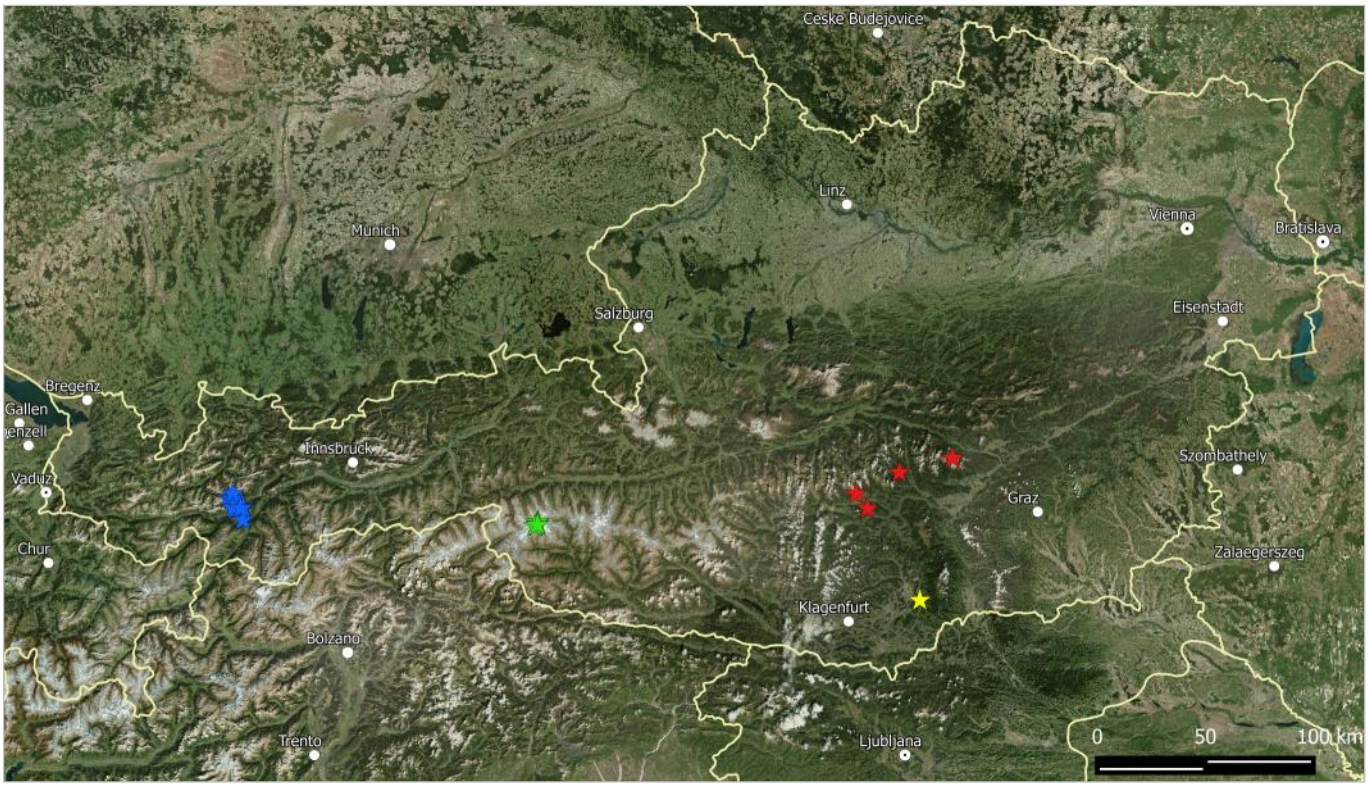


Fig. 2. Localities of the plots of the 11th EDGG Field Workshop (blue: Upper Inn Valley, green: Virgen Valley; red: Mur Valley, yellow: Griffen) Source: Bing Maps (Microsoft, Redmond, USA).

Fig. 3. The palaeoendemic *Sempervivum pittonii*, Gulsen. Photo: M. Magnes.

Fig. 4. *Notholaena marantae*, a poikilohydric fern, Gulsen. Photo: M. Magnes.

but this place was not visited by Braun-Blanquet (1961), as the species was first found by Melzer in 1962 (Melzer 1962) and later recognized and described as a new species (Martinovksy 1970). Probably this *Stipa* population could survive the climate conditions during the warmer and more humid postglacial periods on the rocks of black mica schist above the dry grassland, which heat up in summer. With the exception of Neumarkt, all the sites showed typical signs of woody and ruderal encroachment following abandonment. *Brachypodium pinnatum* had high cover values, indicating that clearing and mowing was severely needed after several years without grazing (Fig. 7). As typical for early fallows, the species richness was very high (more than 60 species on 10 m^2 on a plot in Pöls).

Virgen Valley in East Tyrol

The region is not as arid as all the other studied sites, but the annual temperature amplitude is very high. The winters are bitterly cold at about 1,400 m a.s.l., but *Triticum aestivum* was cultivated here until the 1980s. The moderate aridity in this part of Austria is remarkable, as the Virgen Valley is situated south east of the giant mountain massif Großvenediger and is also shielded from the south by the Lasörling range. Our targets were: a never fertilized hay meadow that is cut not earlier than August (Marin); a subalpine hay meadow ("Bergmähder", on southeastern slopes of the Zinizachspitze); and a pasture around a rock outcrop ("Burg" Obermauern).

In the first week of July, the mean height of the plants on the never fertilized, steep meadow in Marin was less than 30 cm, the endemic *Onobrychis arenaria* subsp. *taurerica* was in full bloom and we recorded up to 59 species on 10 m^2.

The steep southeast-facing slopes of the Zinizachspitze are partly non-forested because of frequent avalanche damages, but were also used for haymaking until recently. In this site and the high-elevation meadow above Kauns in the Upper Inn Valley, were found the highest species richness on 10 m^2 during our Field Workshop. This included rare species, such as *Astragalus penduliflorus*, *Pedicularis elongata, Oxytropis campestris* and *Festuca norica*.

Fig. 5. View to the southern slopes of Gulsen 1954 and 2005. Left photo: J. Eggler, from Eggler (1955), right photo: M. Magnes.

Fig. 6. Habitat of *Stipa styriaca* near Pöls. Photo: M. Janišová.

Our last site in Virgen was the "Burg" in Obermauern, a small hill of limestone mica schist, partly covered with moraine material, with a maximum elevation of 1,416 m a.s.l. The area has been used as a pasture for cattle but nevertheless some parts of the former larger areas of rocky grassland are now overgrown by *Juniperus sabina* – the former traditional grazing was obviously more intensive. Besides the flowering *Dianthus sylvestris* there were also other typical species for inneralpine valleys such as *Festuca valesiaca, Poa badensis* and *Mannia fragrans.*

Upper Inn Valley south east of Landeck

The next sampling location was the Upper Inn Valley south east of Landeck, where we arrived after crossing the Alpine divide through the Felber Tauern tunnel and the Pass Thurn. The dry grasslands of the Upper Austrian Inn Valley were treated together with the Lower Engadine by Braun-Blanquet (1961) because of the similarity in geology, aridity of the climate but also the dry grassland vegetation.

Geologically, the Kaunerberg and the study sites below the castle Laudegg belong to the easternmost part of the Engadine window. This tectonic window exposes a complex series of some of the oldest geological units of the Eastern Alpine system (Gruber et al. 2010).

The studied dry grassland sites in the area bear witness to an old cultural landscape. Traditionally, these sites were common land and were used to pasture small livestock (mainly sheep, to a lesser extent goats) in spring and autumn, before and after they were summered on the alpine pastures at higher elevations. This utilization dates back to at least the Medieval period but it is likely much older. Until the 1940s and early 1950s, several hundred animals were herded in the slopes below Fließ. This practice was however

Fig. 7. Tall growing semi-dry grassland near Pöls with the dark mica schist outcrops. Photo: J. Dengler.

Fig. 8. The Fließer Sonnenhänge 1955 and 2018. Photos: Naturpark Kaunergrat (left), P. Kirschner (right).

abandoned due to the economic upturn of the post-war era, and led to a reforestation and a subsequent degradation of the respective sites (Fig. 8). This negative trend lasted until 2002, when, following the year-long pressure of regional conservationists, the sites at Fließ were finally put under protection, and were integrated into the Natura 2000 network. The sites at Kauns-Kaunerberg followed shortly after, and have been protected under Tyrolean law since 2006. Both sites have been managed by the Nature Park Kaunergrat since then. Management measures include the initial re-establishment of degraded areas by removal of shrubs and trees, and subsequent, targeted grazing by cattle, goats and sheep. Since implementation, these activities have been regularly evaluated via monitoring studies on vegetation and selected insect taxa (butterflies, ants), coordinated by the Kaunergrat Nature Park. Despite some degradation, the dry grasslands in the region are still the best example of inneralpine dry valleys in Austria, and the activities of the members of the Naturpark Kaunergrat have led to an improvement of the situation.

Griffen in Carinthia

On the last day of the Field Workshop we sampled one last 10-m^2 plot at the southern slope of the Griffener castle hill, a place that had already been investigated by Braun-Blanquet (1961). Since the municipality Griffen has bought the castle hill, parts within the security walls of the castle have been cleared and are mown regularly. The place has a promising potential not only to attract tourists but to develop species-rich grassland.

Initial results and discussion

Phytodiversity

As mentioned before 15 EDGG biodiversity plots (nested-plot series) and 37 additional 10 m^2 plots were sampled. The most frequent vascular plants in the 67 10 m² plots were *Euphorbia cyparissias* (56.7%), *Carex humilis* (55.2%), *Carex caryophyllea* (52.2%) and *Helianthemum nummularium* subsp. *obscurum* (52.2%). Among bryophytes, *Abietinella abietina* (56.7%) and *Rhytidium rugosum* (46.3%) were the most frequent species. Lichens were present only in a subset of plots, so that the most frequent species, *Cladonia pyxidata* and *C. symphycarpa*, reached only 16.4% and 14.9% in the whole dataset, respectively. Fig. 9 shows some of the lichens observed during the Field Workshop.

Mean total species richness ranged from 3.0 on 1 cm² via 28.3 on 1 m², 41.5 on 10 m² to 69.1 on 100 m² (Table 1). Most of the species were vascular plants with on average 34.1 on 10 m², followed by 4.2 bryophytes and 2.0 lichens, but for the latter two groups the diversity varies much between plots (Table 1). Maxima of total species richness were

Table 1. Preliminary species richness data from the 11th EDGG Field Workshop in Austria.

		Total richness		Vascular plants		Bryophytes		Lichens	
Area [m²]	*n*	Mean	Range	Mean	Range	Mean	Range	Mean	Range
0.0001	30	3.0	1–9	2.4	0–8	0.3	0–3	0.1	0–2
0.001	30	4.8	0–11	3.9	0–11	0.5	0–3	0.2	0–2
0.01	30	8.2	1–19	6.7	0–18	0.9	0–5	0.4	0–2
0.1	30	17.4	6–36	14.5	4–33	1.8	0–6	0.8	0–4
1	30	28.3	10–54	23.6	9–49	2.6	0–7	1.6	0–9
10	67	41.5	20–90	34.1	16–86	4.2	0–17	2.0	0–14
100	15	69.1	38–103	55.6	25–94	6.9	2–16	5.8	0–17

Fig. 9. Some of the lichens determined by our lichenologist (H.M.): 1: *Toninia sedifolia* (left, the dark one) and *Fulgensia bracteata*, Photo: J. Dengler; 2: *Buellia elegans*, Photo: J. Dengler; 3: *Cladonia pyxidata* (left) and *Peltigera rufescens*, Photo: J. Dengler; 4: *Xanthoparmelia stenophylla*, Photo: J. Dengler; 5: *Thamnolia vermicularis* var. *subuliformis*, Photo: M. Magnes, 6: *Peltigera membranacea*, Photo: J. Dengler.

54, 90 and 103 on 1, 10 and 100 m², respectively, and 49, 86 and 94 for vascular plants (Table 1).

The Virgen Valley was the region with the highest mean species numbers at all plot sizes. The high values cannot be explained only by the extremely species-rich high mountain meadows, as the values remained still the highest for this region even after excluding the relevés coming from such meadows from the richness calculations. The regional species richness is probably positively influenced by the least arid climate among the studied regions. High aridity, especially in the Alps, can influence species richness negatively. For example, Wiesner et al. (2015) pointed out the conspicuous species poorness of *Festuco-Brometea* grasslands in the Aosta Valley area. Of similar importance is the tradition-

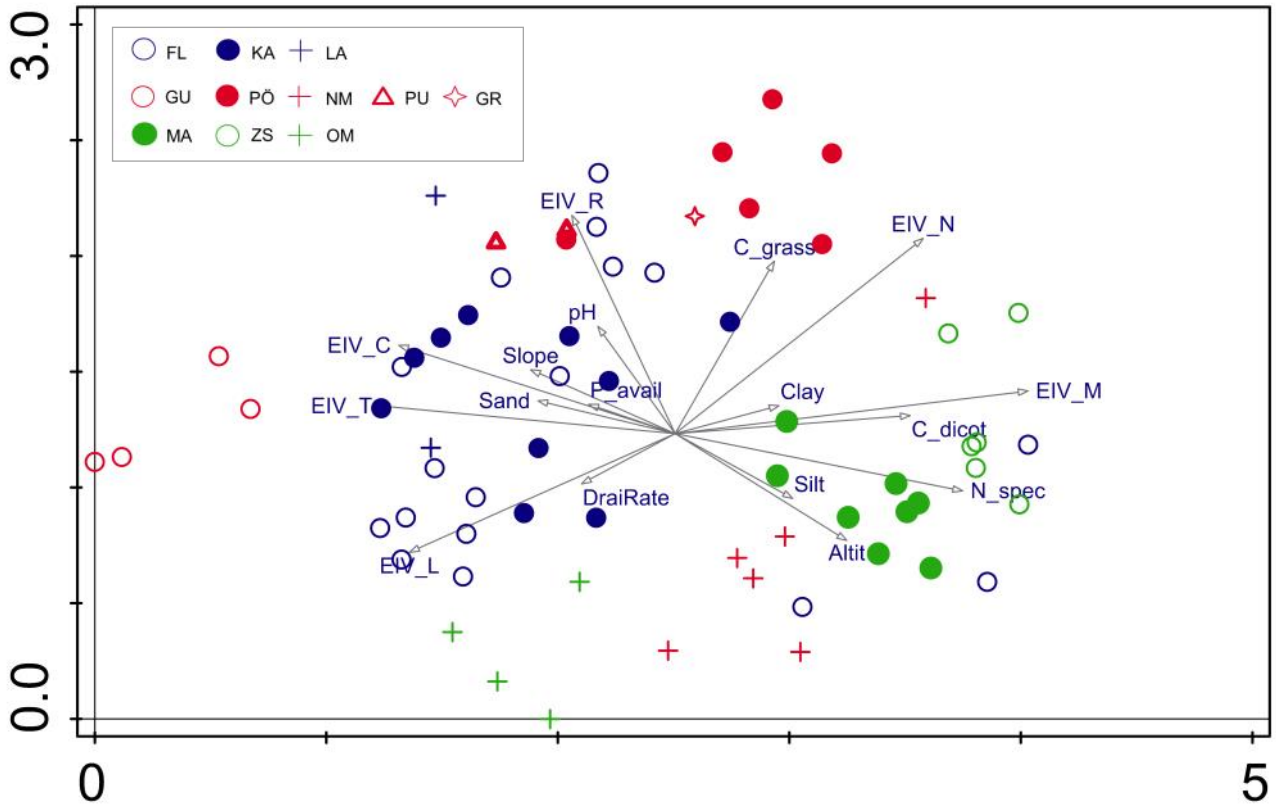


Fig. 10. DCA plot of the 10 m^2 plots sampled during the 11th EDGG Field Workshop (cover values log-transformed, gradient lenght/eigenvalue of Axis 1: 4.03/0.5048, Axis 2: 2.68/0.2823); blue: Upper Inn Valley: FL Fließ, KA Kauns, LA Ladis; red: Mur Valley and Griffen: GU Gulsen, PÖ Pöls, NM Neumarkt, PU Puxerloch, GR Griffen; green: Virgen Valley: MA Marin, ZS Zinizachspitze, OM Obermauern; vectors: pH (measured, in Aqua dest.), DraiRate: Drainage rate, measured, P_avail: Phosphorus available, measured in Mehlich 3 method; Sand, Silt, Clay in percent; N_spec: species number per plot; C_grass: cover grass species; C_dicot: cover dicotyledones, Altit: altitude; Slope: average slope inclination; EIV = Ellenberg Indicator Value, EIV_C: EIV for continentality; EIV_N: EIV for nutrients, EIV_M: EIV for moisture; EIV_R: EIV for soil reaction; EIV_T: EIV for temperature; EIV_L: EIV for light.

al management of the pastures and meadows practiced continuously until recent times in the Virgen Valley. The second richest region was the Upper Inn Valley. This region, the most continental of all our study areas, has a long grazing tradition and the large pastures were used from spring until the flocks of sheep and goats could move to the high-mountain pastures – in some years not before July. The last region with regards to species richness is the Styrian Mur Valley. Most of the sites are rather small remnants and pasturing ceased around the 1950s. Even the grasslands of Gulsen, while hosting interesting specialists, were rather species poor because of the serpentinite affecting the soil chemistry.

Vegetation composition and vegetation change

We conducted a Detrended Correspondence Analysis (DCA) with the 10 m^2 plots sampled during the Field Workshop to show the differences in species composition between the sampling locations, and the environmental gradients behind them (Fig. 10). For this purpose, we passively plotted in the DCA diagram Ellenberg Indicator Values (EIV) calculated for each plot as well as several environmental variables, namely altitude and measured soil parameters. Although the aridity (especially summer drought) in the Austrian parts of the inneralpine dry valleys is never as severe as in the Western or Southwestern Alps, this gradient is visible in the compositional data and is indicated by the vector of the EIV (not weighted mean) for continentality (EIV_C). The other important gradient in the compositional data is the soil reaction: both the vector of the EIV for soil reaction (EIV_S) and the vector of the measured pH go nearly parallel to axis 2 in the DCA plot.

DCA was used to analyse the plots sampled during the Field Workshop together with the historical plots (Kielhauser 1953, 1954; Braun-Blanquet 1961; Wagner 1985). The resulting ordination diagram is shown in Fig. 11. Figs. 10 and 11 show that plots from Gulsen (GU) occupy a distinct position, both recent plots and historical plots sampled by Braun -Blanqet (blue encircled plots in Fig. 11). This distinct position reflects not only the different flora on serpentinite but

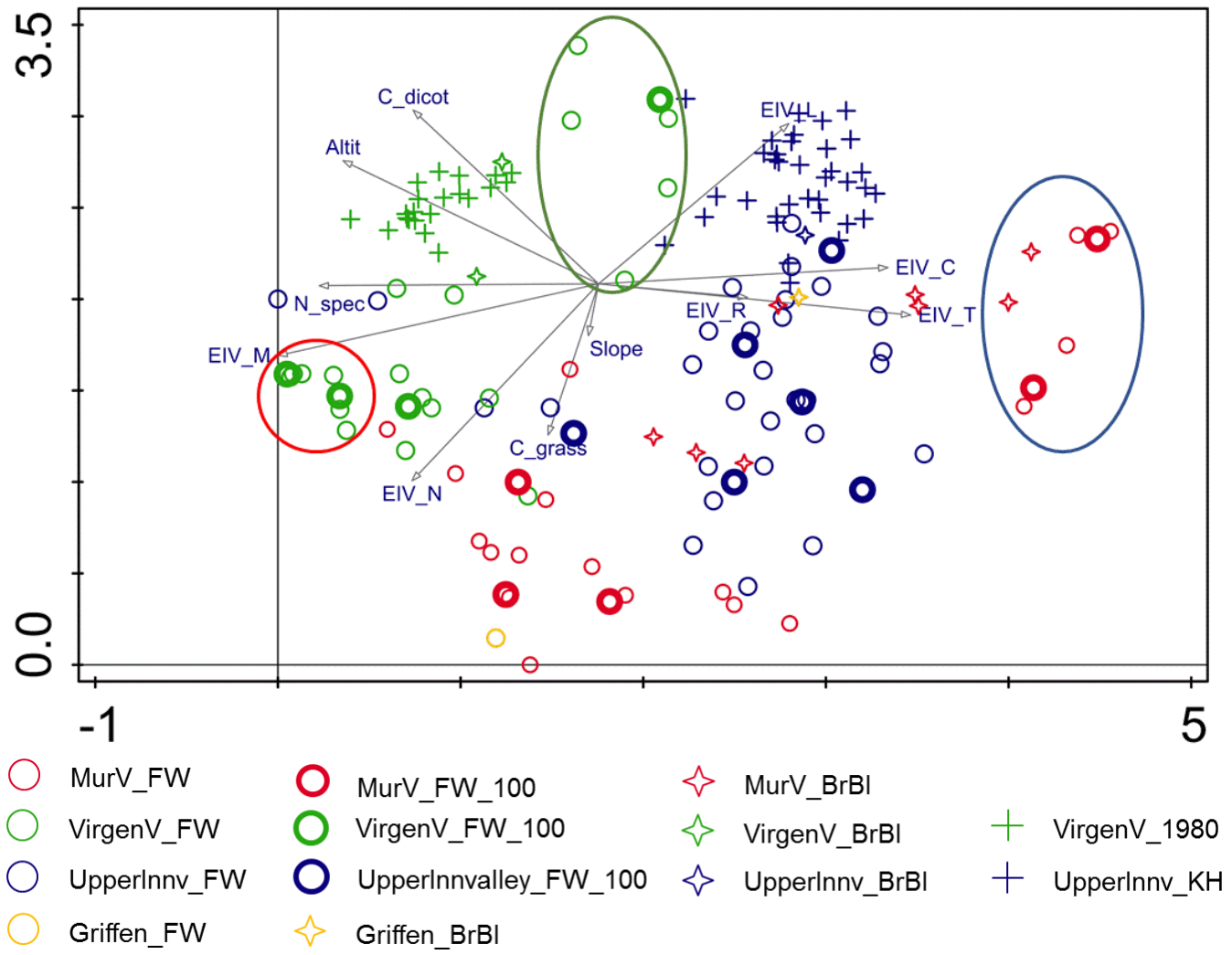


Fig. 11. DCA plot of the relevés sampled during the 11th EDGG Field Workshop (x_FW: data from the 10 m² plots; x_FW_100: data from the 100-m² plots) together with relevés from the Austrian Inneralpine dry valleys sampled in the 1950s and 1980s (Braun-Blanquet 1961: x_BrBL, Kielhauser 1953 and 1954: x_KH and Wagner 1985: x_1980); blue circled plots: Gulsen, green circled plots: Obermauern, red circled plots: Zinizachspitze; cover values log-transformed, gradient lenght/eigenvalue of Axis 1: 4.56/0,539, Axis 2: 3.39/0,318). Vectors: N_spec: species number per plot; C_grass: cover grass species; C_dicot: cover dicotyledones, Altit: altitude; Slope: average slope inclination; EIV = Ellenberg Indicator Value, EIV_C: EIV for continentality; EIV_N: EIV for nutrients, EIV_M: EIV for moisture; EIV_R: EIV for soil reaction; EIV_T: EIV for temperature; EIV_L: EIV for light. To test whether the larger plot sizes of the previous authors are not the most important drivers of the different compositional variability (affecting the positions in the DCA ordination space) for the comparison with the historical relevés we included also the data from the 100 m² plots (x_FW_100). The species cover values were calculated by averaging the values obtained in the two 10 m² corner-plots, while the species occurring only outside the corner plots got the cover value 0.1.

also the relative species poorness caused by this Mg-rich bedrock. This is the only region where the recent sites appear on more continental and dryer parts of the gradient than those from the 1950s.

The distinct position in the DCA of the grasslands from Virgen Valley mediates between the Mur Valley and the more continental sites of the Upper Inn Valley. Both the species rich subalpine hay meadows on the slopes of the Zinizachspitze (red circle in Fig. 11) and the rocky grasslands on the moraine material near the valley bottom in Obermauern (green circle in Fig. 11) form distinct groups. Fig. 11 also evidences the compositional distance among old and recent plots from Kaunergrat (Upper Inn Valley), probably due to the decrease in light demanding species. The large distance between the recent and the historical plots from Griffen in the DCA of Fig. 11 can be explained by the different ecological situation of the sites: while Braun-Blanquet (1961) was working in rocky grassland, our group sampled a site within the Castle area to obtain information on the quality of the management.

Fig. 12. Some *Lepidoptera* species of the studied grasslands: 1: *Rhuemaptera hastata*, 2: *Parnassius apollo*, 3: *Melitaea* sp. (det. A. Mora). Photos: J. Dengler.

Butterflies

Four out of the 15 biodiversity plots and two out of the 37 additional plots were also sampled for butterflies (see Fig. 12 for examples). Specific weather conditions (over 17º C, no rain or heavy winds) have to be met to sample butterflies, which is very different to sampling plants. The plot surface was walked through to cover all the different biotopes for butterflies. Plot area and observation time were recorded in each case. All species were identified. Standardized adult counts (Pollard & Yates 1993) were accomplished when possible (four out of the six sites sampled). Information about land-use and landscape context was also recorded.

Butterfly species richness was calculated for each sampled site, as well as the percentage of specialist species (larvae feeding only on 1 or 2 host plants), the percentage of generalist species (larvae feeding on more than 10 species), and the average fore-wing length of the species present (as a proxy for butterfly mobility). Host plants and fore-wing lengths were consulted in Paolucci (2013), and host plants for sampled butterfly species were identified in the species lists obtained in the sampled plots.

The highest butterfly species richness was found in Zinizachspitze (Virgen Valley) (19 species sampled), with a remarkable 26% of grassland specialists (with only 1 or 2 host plants for larvae) and some interesting species, such as the endangered *Phengaris arion* (Van Swaay et al. 2010), or *Coenonympha gardetta*, *Erebia albergana* and *Aricia artaxerxes*. In this location, 18 possible functional associations between host plants and butterfly species were detected, the highest number for all sites visited. Interestingly, two of the uncommon species sampled in this location, *Phengaris arion* and *Aricia artaxerxes* have symbiotic relationships with ants, who attend their larvae and pupae (*Myrmica sabuleti* or *M. scabrinodis* for *Phengaris arion* and *Lasius* spp. for *Aricia artaxerxes*). All these data suggest that land-use has been stable for a long time and that the plot is not isolated in the landscape (there is enough area to sustain viable metapopulations).

In the other five sites sampled, simple communities with few species were found, with very uneven distribution of abundances (one or two dominating species) and few possible associations between plants and butterflies. The average fore-wing length was bigger in these poorer and more disturbed places, suggesting recent disturbance and recolonization only by highly mobile and generalist species. Other recorded species of interest were *Neptis rivularis* in Pöls, typical of the original mixed deciduous woodland of the location, a sporadic and uncommon species after Paolucci (2013). *Parnassius apollo*, considered Near Threatened in the European Red List (Van Swaay et al. 2010) was found in three localities (Fig. 12).

Reduction in landscape variety by means of intensified agriculture and forest plantations has led to the simplification of butterfly communities, dominated by generalist and highly mobile species. Dainese et al. (2017) demonstrated for 561 seminatural grasslands across seven European regions that local plant diversity showed a strong bottom-up effect on butterfly diversity in the most complex landscapes, but this effect disappeared in simple landscapes. Our observations support this hypothesis.

Conclusions and outlook

The first insights into the dry grasslands of the inneralpine valleys of Austria demonstrate that they are an interesting study subject despite their small remaining areas. They are dependent on management measures to preserve their special species composition - which has been recently updated and documented by the data generated during this Field Workshop. The region with the best preserved traditional agronomy, the Virgen Valley, especially the subalpine meadows (also these in the Upper Inn Valley) harbor the highest plot-scale species richness of vascular plants, bryophytes and lichens. The butterfly investigation showed similar results. The data have already been fed into the GrassPlot database (Dengler et al. 2018; Biurrun et al. 2019) to be used in supraregional biodiversity studies across the Palaearctic. Participants of the Field Workshop plan two follow-up studies, one on the syntaxonomic assignment of the studied grasslands and one on the butterfly communities. Of particular interest will also be the comparison with the results of the 12th EDGG Field Workshop in the inneralpine valleys of Switzerland (Dengler et al. 2020a).

Author contributions

M.M. organised the Field Workshop together with H.M. and P.K. He also wrote the first draft of the text. J.D., I.B. and I.D. as the past and current EDGG Field Workshop Coordinators provided and ensured the standardised methodology and gave major input to the report. A.M. sampled butterflies and wrote the corresponding section. P.K., M.J., H.M., C.B., E.A. and W.W. made significant contributions, E.B., I.B., M.J. and M.M. jointly compiled the photo diary in the Appendix. All authors were involved in the field sampling except C.B. who determined bryophytes and E.A. who analysed soils. Many authors contributed photos (see captions). All authors read and approved the manuscript.

Acknowledgments

We are grateful to the IAVS and the University of Graz for financial support for some of the participants. We would like to thank Peter Hochleitner, the Natura 2000 site supervisor of some parts of the Mur Valley we studied for helping with the organization of the workshop and some introduction to the management plans and the Naturpark Kaunergrat for authorizing sampling in the protected areas and for guiding and information.

References

Biurrun, I., Burrascano, S., Dembicz, I., Guarino, R., Kapfer, J., Pielech, R., García-Mijangos, I., Wagner, V., Palpurina, S., (...) & Dengler, J. 2019. GrassPlot v. 2.00 – first update on the database of multi-scale plant diversity in Palaearctic grasslands. *Palaearctic Grasslands* 44: 26-47.

Braun-Blanquet, J. 1961. Die inneralpine Trockenvegetation. Von der Provence bis zur Steiermark. *Geobotanica Selecta* 1: 1–273.

Brooks, R.R. 1987. *Serpentine and its vegetation*. Croom Helm, London, UK.

Dainese, M., Isaac, N.J.B., Powney, G.D., Bommarco, R., Öckinger, E., Kuussaari, M., Pöyry, J., Benton, T.G., Gabriel, D., (…) & Marini, L. 2017. Landscape simplification weakens the association between terrestrial producer and consumer diversity in Europe. *Global Change Biology* 23: 3040–3051.

Dengler, J., Becker, T., Ruprecht, E., Szabó, A., Becker, U., Beldean, M., Biţă-Nicolae, C., Dolnik, C., Goia, I., (…) & Uğurlu, E. 2012. *Festuco-Brometea* communities of the Transylvanian Plateau (Romania) – a preliminary overview on syntaxonomy, ecology, and biodiversity. *Tuexenia* 32: 319–359.

Dengler, J., Boch, S., Filibeck, G., Chiarucci, A., Dembicz, I., Guarino, R., Henneberg, B., Janišová, M., Marcenò, C., (…) & Biurrun, I. 2016a. Assessing plant diversity and composition in grasslands across spatial scales: the standardised EDGG sampling methodology. *Bulletin of the Eurasian Grassland Group* 32: 13–30.

Dengler, J., Biurrun, I., Apostolova, I., Baumann, E., Becker, T., Berastegi, A., Boch, S., Cancellieri, L., Dembicz, I., (…) & Weiser, F. 2016b. Scale-dependent plant diversity in Palaearctic grasslands: a comparative overview. *Bulletin of the Eurasian Dry Grassland Group* 31: 12–26.

Dengler, J., Wagner. V., Dembicz, I., García-Mijangos, I., Naqinezhad, A., Boch, S. Chiarucci, A., Conradi, T., Filibeck, G., (…) & Biurrun, I. 2018. GrassPlot – a database of multi-scale plant diversity in Palaearctic grasslands. *Phytocoenologia* 48: 331–347.

Dengler, J., Gehler, J., Aleksanyan, A., Fayvush, G. & Biurrun, I. 2019. EDGG Field Workshops 2019 – the international research expeditions to study grassland diversity across multiples scales and taxa: Call for participation. *Palaearctic Grasslands* 41: 9–22.

Dengler, J. Guarino, R., Moysiyenko, I., Vynokurov, D., Boch, S., Cykowska-Marzencka, B., Babbi, M., Catalano, C., Eggenberg, S., (...) & Dembicz, I. 2020a. On the trails of Josias Braun-Blanquet II: First results from the 12th EDGG Field Workshop studying the dry grasslands of the inneralpine dry valleys of Switzerland. *Palaearctic Grasslands* 45: 59–88.

Dengler, J., Matthews, T.J., Steinbauer, M.J., Wolfrum, S., Boch, S., Chiarucci, A., Conradi, T., Dembicz, I., Marcenò, C., (…) & Biurrun, I. 2020b. Species-area relationships in continuous vegetation: Evidence from Palaearctic grasslands. *Journal of Biogeography*. 47: 72–86.

Eggler, J. 1955. Ein Beitrag zur Serpentinvegetation in der Gulsen bei Kraubath in Obersteiermark. *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark* 85: 27–73.

Fischer, M.A., Oswald, K. & Adler, W. 2008. *Exkursionsflora für Österreich, Liechtenstein und Südtirol*. Land Oberösterreich, Linz, AT.

Frahm J. P. & Frey W. 2004. *Moosflora*. Ulmer, Stuttgart, DE.

Gruber, A., Pestal, G., Nowotny, A. & Schuster, R. 2010. Erläuterungen zu Blatt 144 Landeck. In: *Geologische Karte der Republik Österreich 1:50.000: Erläuterung*. Verlag der Geologischen Bundesanstalt (GBA), Wien, AT.

Kielhauser, G.E. 1953. Die Vegetation des Kaunerberges als Ausdruck des dortigen extremen Klimas. *Wetter und Leben* 5: 43–46.

Kielhauser, G.E. 1954. Die Trockenrasengesellschaften des *Stipeto-Poion xerophilae* im oberen Tiroler Inntal. *Angewandte Pflanzensoziologie, Festschrift Aichinger Band* 1: 646–666.

Kuzemko, A., Becker, T., Didukh, Y.P., Ardelean, I.V., Becker, U., Beldean, M., Dolnik, C., Jeschke, M., Naqinezhad, A., (…) & Dengler, J. 2014. Dry grassland vegetation of central Podolia (Ukraine) - A preliminary overview of its syntaxonomy, ecology and biodiversity. *Tuexenia* 34: 391–430.

Kuzemko, A., Steinbauer, M.J., Becker, T., Didukh, Y.P., Dolnik, C., Jeschke, M., Naqinezhad, A., Uğurlu, E., Vassilev, K. & Dengler, J. 2016. Patterns and drivers of phytodiversity in steppe grasslands of Central Podolia (Ukraine). *Biodiversity and Conservation* 25: 2233–2250.

Magnes, M. 2018a. Das Klima der Steiermark als wichtiger Faktor für die Vegetation und den Weinbau. *Tuexenia Beiheft* 11: 33–38.

Magnes, M. 2018b. Sonderstandorte in einem inneralpinen Trockental: Spezialisten auf Serpentinit und paläozischen Kalken im oberen Murtal. *Tuexenia Beiheft* 11: 113–124.

Magnes, M., Mayrhofer, H., Kirschner, P., Stöhr, O., Schwager, P., Dengler, J. & Biurrun, I. 2018. Invitation and guide to the 11th EDGG Field Workshop: Grasslands of Inneralpine dry valleys: part 1, Eastern Alps. *Bulletin of the Eurasian Dry Grassland Group* 36: 12–25.

Martinovský, J.O. 1970. Über drei neue *Stipa*-Sippen aus dem Verwandtschaftskreis *Stipa joannis* s. l. XXII. Beitrag zur Kenntnis der *Stipa*-Sippen. *Österreichische Botanische Zeitschrift* 118: 171–181.

Melzer, H. 1962. Neues zur Flora von Steiermark (V). *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark* 92: 77–100.

Nimis, P.L., Hafellner, J., Roux, C., Clerc, P., Mayrhofer, H., Martellos, S. & Bilovitz, P.O. 2018. The lichens of the Alps – an annotated checklist. *MycoKeys* 31: 1–634.

Paolucci, P. 2013. *Butterflies and burnets of the Alps and their larvae, pupae and coccoons.* WBA Handbooks 4, Verona, IT.

Pedashenko, H., Apostolova, I., Boch, S., Ganeva, A., Janišová, M., Sopotlieva, D., Todorova, S., Ünal, A., Vasslilev, K., (…) & Dengler, J. 2013. Dry grasslands of NW Bulgarian mountains: first insights into diversity, ecology and syntaxonomy. *Tuexenia* 33: 309–346.

Pollard, E. & Yates, T.J. 1993. *Monitoring butterflies for ecology and conservation: The British Butterfly Monitoring Scheme*. Chapman & Hall, London, UK.

Polyakova, M.A., Dembicz, I., Becker, T., Becker, U., Demina, O.N., Ermakov, N., Filibeck, G., Guarino, R., Janišová, M., (…) & Dengler, J. 2016. Scale- and taxon-dependent patterns of plant diversity in steppes of Khakassia, South Siberia (Russia). *Biodiversity and Conservation* 25: 2251–2273.

Turtureanu, P.D., Palpurina, S., Becker, T., Dolnik, C., Ruprecht, E., Sutcliffe, L.M.E., Szabó, A. & Dengler, J. 2014. Scale- and taxon-dependent biodiversity patterns of dry grassland vegetation in Transylvania. *Agriculture, Ecosystems & Environment* 182: 15–24.

Van Swaay, C., Cuttelod, A., Collins, S., Maes, D., López Munguira, M., Šašić, M., Settele, J., Verovnik, R., Verstrael, T., (...) & Wynhoff, I. 2010. *European Red List of Butterflies.* Publications Office of the European Union, Luxembourg, LU.

Wagner, H. 1985. Zur Trockenvegetation des Virgentales (Osttirol). *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich* 123: 239–246.

Wiemers, M., Baletto, E., Vlad, D., Fric, Z.F., Lamas, G., Lukhtanov, V., Munguira, M.L., Swaay, C.A.M., Vila, R., (…) & Verovnik, R. 2018. An updated checklist of the European Butterflies (Lepidoptera, Papilionoidea). *ZooKeys* 811: 9–45.

Wiesner, L., Baumann, E., Weiser, F., Beierkuhnlein, C., Jentsch, A. & Dengler, J. 2015. Scale-dependent species diversity in two contrasting dry grassland types of an inner alpine dry valley (Cogne, Aosta Valley, Italy). *Bulletin of the Eurasian Grassland Group* 29: 10–17.

Appendix: a photo diary of the Field Workshop

Edited by Elena Belenovskaya, Idoia Biurrun, Monika Janišová & Martin Magnes

6 July – Mur Valley: Gulsen near Kraubath
The meeting point was at the Institute of Biology, Division of Plant Sciences in the Botanical Garden of the University of Graz, a second part of the group was collected at the railway station in Bruck an der Mur. Bad weather and rain couldn't spoil the pleasure of our meeting. After joyful greetings we moved to Gulsen, the biggest serpentinite outcrop of Central Europe. We climbed the steep forest steppe part up to the even steeper treeless rocky grassland areas. *Sempervivum pittonii* was in flower and other plants that in Central Europe are often restricted to serpentinite were fully developed.
As a bonus, we had a wonderful dinner and comfortable accommodation in the hospitable Pöllauer Hof.

The steep slopes of the Gulsen. Photo: M. Janišová.

Discussing plant and lichen species on the Gulsen. Photo: M. Janišová.

The Gulsen dry grassland through the butterfly specialist´s eye (*Cucullaria verbasci* on *Verbascum chaixii* subsp. *austriacum*, det. M.M). Photo: A. Mora.

Dinner at the hospitable Pöllauer Hof. Photo: J. Dengler.

For identification of our plants, there is enough space in the smallest lobby. Photo: J. Dengler.

7 July – Mur Valley: Oberkurzheim near Pöls; Puxerloch, Neumarkt in der Steiermark

We were woken up by the bell of the nearby church of Pöllau. The morning was bright and sunny and the day also promised to be nice. After a nice big breakfast, our first site was Oberkurzheim near Pöls, where we met Peter Hochleitner, who had organized the re-introduction of management on the last habitat of *Stipa styriaca*.

Oberkurzheim, near the habitat of *Stipa styriaca*. Photo: J. Dengler.

***Stipa styriaca* grassland evoked smiles on scientists' faces. Photo left: M. Magnes, Photo right: M. Janišová.**

Also a couple of *Euthystira brachyptera* enjoyed the nice view in the *Stipa styriaca* habitat Photo: M. Magnes (det. P.K.).

Quo vadis *Stipa styriaca*? Photo: M. Janišová.

After lunch we divided into two groups: one half followed Peter, who had managed to clear an overgrown grassland on acidic bedrock near Neumarkt in der Steiermark, while the other group visited the rocky grassland near the rock fortress at the Puxerloch. Luckily all the group sampling near Puxerloch returned safely to the hotel, although there were some difficulties staying in place on such a steep slope. Back in our hotel we had delicious dinner accompanied by traditional music.
Then there was a scientific session: Ermin spoke about the vegetation of Bosnia and Amparo showed us a wonderful presentation about the landscape and plant and animal diversity in the Picos de Europa National Park (Cantabrian Range, northern Spain).

Dark-eyed beauty in Oberkurzheim (Murbodner). Photo: E. Mašić.

Recently cleared grassland patch in Neumarkt. Photo: R. Guarino.

Really steep rocky grassland patch at the Puxerloch. Photo: M. Janišová.

8 July – East Tyrol: Virgen
This day we went to East Tyrol. We had a short coffee break near the north shore of the Wörther See. We enjoyed a wonderful view of the mountain lake and continued driving along the Drau Valley up to Lienz, the capital of East Tyrol. From here we followed the Isel Valley, in Matrei in Osttirol we followed the right tributary, the Virgen Valley to the village Virgen and checked in at the Pension Waldruhe. After lunch we organised a sampling session on a very steep hay meadow owned by our host family. After dinner we used the hay barn for identification and pressing our plants. When the moon came out, we enjoyed a wonderful opera performance by Riccardo.

The Wörther See with the famous summer-green from the North, in the background the Karawanken. Photo: M. Janišová.

Lunch in Virgen. Photo: J. Dengler.

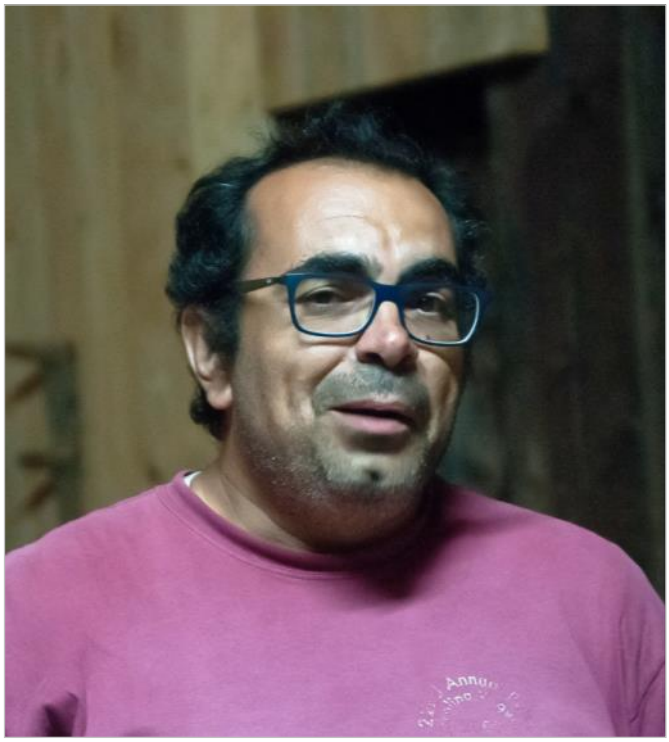
The meadow of our host family in Marin. Photo: J. Dengler.



Meadow in Marin, *Onobrychis arenaria* subsp. *taurerica*, *Briza media*. Photos: M. Magnes.

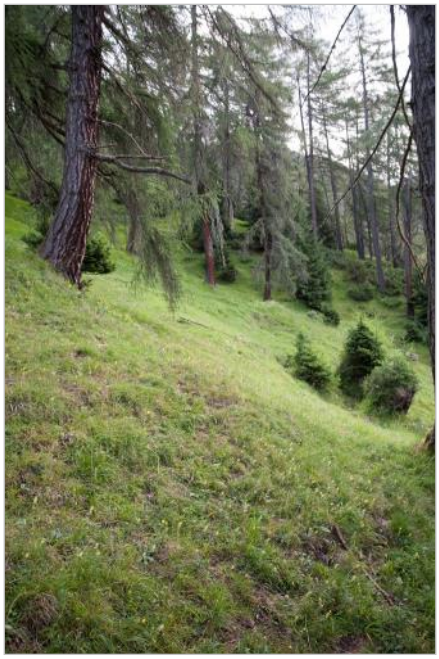

Despite the thunderstorm our enthusiastic group started to sample another plot shortly before dinner. Photo: M. Janišová.


What place could be more appropriate to dry the plants than a hay barn? Photo: M. Janišová.



The young tenor from Palermo received a big applause. Photo: J. Dengler.

9 July – East Tyrol: Virgen Valley, Zinizachspitze, Obermauern
The next day we started early in the morning and walked to the former subalpine hay meadow owned by our host family. This meadow is located on the south-eastern slope of the Zinizachspitze, in the so called "Firschnitz". We passed the Allerheiligen-Chapel, built in the 8th century on a rock in the traditionally grazed larch forest.
Just below the current timberline at about 2,000 m a.s.l. we started the sampling in an avalanche corridor that was used as a meadow up to the last years. The weather was wonderful, the views were very beautiful and the grasslands were colorful with flowers and lots of marvelous butterflies.



The Allerheiligen Chapel from the 8th century, on the way from Marin to the Zinizachspitze, traditionally pastured larch forests in the subalpine belt. Photos: M. Janišová (left), J. Dengler (right).

What is causing the tumult in the larch forests? Oh, it is the orchid (*Nigritella rhellicani*). Photos: J. Dengler (left), M. Magnes (right).


The richness record owner of the 11th EDGG Field Workshop. Photos: J. Dengler (left), M. Janišová (right).


Working on the steep slopes. Photos: J. Dengler (left), M. Magnes (right).


***Astragalus penduliflorus, Pedicularis elongata*. Photos: J. Dengler.**

The Gottschaunalm, in the background the Rötspitze with the Welitzkees. Photo: R. Guarino.

Lunch at the Gottschaunalm. Although most of us followed the wise alpine advice- "never finish a meal without a distillate" - most participants felt a little bit sick in the upcoming days. Photos: R. Guarino (left), M. Janišová (right).

On the way back to our pension, we had a fine view on our last target of the day, the so called "Burg" Obermauern, a rock outcrop covered partly with moraine sediments.

Obermauern with the pilgrimage church Maria Schnee, in the center the "Burg" Obermauern, steep south eastern faced rocky grassland on the "Burg". Photos: M. Magnes (left), J. Dengler (right).

10 July –Upper Inn Valley: Tyrol, Kauns

After breakfast we left the Pension Waldruhe in our two brave microbuses and we made a short stop at the pilgrimage church Maria Schnee in Obermauern to see the famous fresco paintings of the Passion of Jesus from the 15th century. We went back to Matrei and crossed the Hohen Tauern through the Felber Tauern Tunnel, passing one of the big longitudinal valleys of the Eastern Alps, the Salzach Valley in Mittersill and then the Kitzbühler Schiefer Alpen by the Pass Thurn and made a short break west of Kitzbühel. Then we followed the Brixen Valley to Wörgl, where we reached the Inn Valley. Unexpectedly without any traffic jam, we could ascend the Inn Valley on the highway, passed Innsbruck and made a stop at the service area near Mills. Then we went further to Landeck, where we left the highway and made a lunch stop in the dry grassland area of Fließ. Later we went further to our next pension, the Gasthof Falkeis, where we met Philipp Kirschner. After the check-in we started with our work in the dry grasslands near Kauns, in areas that are now, after some decades of abandonment, grazed by goats again. The grazing is managed by the Naturpark Kaunergrat and this monitoring program can show already some encouraging results. In the evening we got an introduction to the managing programs of the Naturpark Kaunergrat by Ernst Partl and Philipp Kirschner.

Still lots of space in the luggage compartment; the famous fresco paintings in the Maria Schnee church. Photos: A. Mora (left), M. Janišová (right).

Kauner dry grasslands managed by goats, castle Laudegg from the Kaunerberg. Photos: J. Dengler (left), M. Magnes (right).

11 July – Upper Inn Valley: Tyrol, Fließ

In the morning we went to adjacent Fließ, a village on a plateau ("Oberes Gericht") approximately 200 m above the Inn Valley. We started in the western part, on steep slopes that are partly pastured by the Tyrolean Gray Cattle. Then we visited the Archeological museum of Fließ. Riccardo did not only translate the very interesting remarks of our guide to English but also added different aspects from his own historical wealth of experience. It is a small but excellent museum, with lots of artefacts that proof settlements from the early Bronze and Iron Age.

Tyrolean Gray Cattle on the steep pastures of Fließ. Photo: M. Magnes.

Universal scholar Riccardo translating with improvements in the Archaeological Museum of Fließ; axe from the Iron Age with an interestingly cut handle (Archaelogical Museum of Fließ). Photos: J. Dengler (left), M. Janišová (right).

A pasture south east from the village Fließ. Time to think on some kind of recreation. Photos: M. Janišová (left), M. Magnes (right).

On dry and hot stones it´s fine to have a hairy hood (*Syntrichia ruralis, Sempervivum arachnoideum*); is the role as pollinators of butterflies (*Melitaea trivia*) overestimated? Photos: M. Magnes (left), A. Mora (right).

The very steep dry grasslands of the castle hill of Laudegg. Photo: J. Dengler.

12 July –Upper Inn Valley: Tyrol, Ladis – Carinthia: Gösselsdorfer See

After breakfast Monika and Wolfgang left, and Philipp went with Riccardo, Denys and Harald to a subalpine hay meadow above Kauns, while other participants worked either with Helmut on the grasslands of Fließ again or moved to the castle hill of Laudegg. Around noon we met at the service station in Mills where we said goodbye to Philipp. We went back the Inn Valley, took the Pass Thurn and the Felber Tauern tunnel and made a break in Lienz. We reached our last accommodation, the Sablatnighof between the Turner and the Gösselsdorfer See in South Carinthia at about 18.30. After a nice and typical dinner, some of us enjoyed an evening swimming in the remarkable warm Gösselsdorfer See. Then we finished the day with a closing meeting to organize work post expedition.

The last working evening. Photos: J. Dengler.

13 July – Carinthia, Griffen – Graz

After breakfast, Helmut started with all the males and Milica immediately to Graz, while Martin with the rest of the girls went to Griffen, to make the last normal plot on the castle hill, a place that was studied also by Braun-Blanquet. After the day of hard work, we were rewarded by fine drinks at the small restaurant at the top of the castle hill.

Then we successfully returned to Graz and wished each other a happy journey.

Thus the 11th EDGG Field Workshop has finished.

Working hard at the castle hill of Griffen and the reward. Photos: M. Magnes.

HELLO! HALLO! ZDRAVO! HI! HOLA! KAIXO! PRIVET! PRYVIT! CIAO! AHOJ!
The organisers and participants

Photos by Jürgen Dengler, Monika Janišová, Laura Cancellieri, Ermin Masic, Riccardo Guarino & Elena Belonovskaya

Anna Kuzemko

Wolfgang Willner

Asun Berastegi

Itziar García-Mijangos

Harald Rötzer

Riccardo Guarino

Denys Vynokurov

Iwona Dembicz

Philipp Kirschner

Milica Stanišić

Ermin Mašić

Idoia Biurrun

Elena Belenovskaya

Martin Magnes

Laura Cancellieri

Amparo Mora

Helmut Mayrhofer and Peter Hochleitner

Monika Janišová

Jürgen Dengler