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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

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Abstract

The 12th EDGG Field Workshop took place from 11 to 19 May 2019, organised by the Vegetation Ecology Group of the Institute of Natural Resource Sciences (IUNR) of the Zurich University of Applied Sciences (ZHAW). Like in the 11th Field Workshop in Austria, the main target was the "Inneralpine Trockenvegetation" (*Festuco-Brometea* and *Sedo-Scleranthetea*), which was first extensively sampled by Josias Braun-Blanquet and collaborators during the 1950s. We visited the Rhône valley in the cantons of Vaud and Valais, one of the most extreme xerothermic islands of the Alps and the Rhine and Inn valleys in the canton of Grison. In total, 30 nested-plot series (EDGG biodiversity plots) of 0.0001 to 100 m² and 82 plots of 10 m² were sampled in meso-xeric, xeric and rocky grasslands of 25 different sites, ranging from 500 to 1,656 m a.s.l., under different topographic, bedrock and landuse conditions. All vascular plants, bryophytes and lichens were recorded in each plot, along with their cover values. We found on average 28.9 vascular plants on 10 m²; which was the lowest mean species richness of any previous EDGG Field Workshop. These values are comparable to the average species richness values of dry grasslands of the Aosta valley in Italy. The data sampled will be used to understand the biodiversity patterns regionally and in the Palaearctic context as well as to place the Swiss dry grasslands in the modern European syntaxonomic system.

Keywords: biodiversity; bryophyte; dry grassland; Eurasian Dry Grassland Group (EDGG); *Festuco-Brometea*; inneralpine dry valley; lichen; nested plot; *Sedo-Scleranthetea*; species richness; syntaxonomy; vascular plant.

Nomenclature: Juillerat et al. (2017) for vascular plants; Meier et al. (2013) for bryophytes; Nimis et al. (2018) for lichens; Mucina et al. (2016) for syntaxa if no author citation is given.

Abbreviations: EDGG = Eurasian Dry Grassland Group; TWW = *Trockenwiesen und -weiden* (dry meadows and pastures).

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Introduction

Field Workshops (formerly called Research Expeditions) are a major element of the annual activities of the Eurasian Dry Grassland Group (EDGG) (see Vrahnakis et al. 2013). Since the initial expedition to the dry grasslands of Transylvania, Romania (Dengler et al. 2012), the EDGG Field Workshop has sampled high-quality phytodiversity data of grasslands in different regions throughout the Palaearctic biogeographic realm (Dengler et al. 2016a, 2018b; Biurrun et al. 2019), using a standardised methodology (Dengler et al. 2016b). The 12th EDGG Field Workshop was organised in Switzerland from 11–19 May 2019 by the Vegetation Ecology Group of the Institute of Natural Resource Sciences (IUNR) of the Zurich University of Applied Sciences (ZHAW) (Dengler et al. 2019a). This Field Workshop can be considered the ideal continuation of the 11th Field Workshop, which took place from 6–13 July 2018 (see Magnes et al. 2020). Both initiatives aimed at revisiting the grassland sites sampled by Josias Braun-Blanquet and collaborators during the 1950s, prior to the preparation of his renowned monograph on the "Inneralpine Trockenvegetation" (Braun-Blanquet 1961). The 12th Field Workshop visited the continuation of the Tyrolian Inn valley in Switzerland (Lower Engadine), the valleys of Central Grisons (Rhine and tributaries) and the Rhône valley (cantons of Valais and Vaudt), one of the most extreme xerothermic islands of the Alps (Braun-Blanquet 1961).

Because of their continental climate, the inneralpine dry valleys in general host plant communities which are otherwise absent or rarely found in the Alpine Region. Many species typical of the steppic continental vegetation of Central and Eastern Europe have their most western, isolated outpost of their distribution range in the inneralpine dry valleys. The occurrence of these isolated outposts is due to the lower elevations of these inneralpine valleys, which makes them climatic islands, whose environmental conditions are very dissimilar to the more oceanic lower parts of the respective river valleys as well as the higher elevational zones of the Alps. The colonization routes were mostly driven by the Pleistocene climatic fluctuations. The long-lasting isola-

Fig. 1. The Field Workshop team on 14 May 2019, having lunch break in the dry grasslands below Erschmatt, just above the deep gorge of the Feschilju stream near the Medieval "Ho Briggu" (High Bridge). From left to right: last row: Chiara Catalano, Manuel Babbi, second row: Iwona Dembicz, Riccardo Guarino, Wolfgang Willner, third row: Eline Staubli, Jamyra Gehler, Jonathan Pachlatko, fourth row: Sabrina Keller, Beata Cykowska-Marzencka, Jürgen Dengler, Denys Vynokurov, fifth row: Ivan Moysiyenko. Photo: D. Vynokurov.

Visp (Rhône valley), 639 m a.s.l.
(MAT: 9.4 °C, Precip.: 596 mm)

Chur (Rhine valley), 556 m a.s.l.
(MAT: 10.0 °C, Precip.: 849 mm)

Scuol (Inn valley), 1,304 m a.s.l.
(MAT: 5.5 °C, Precip.: 706 mm)

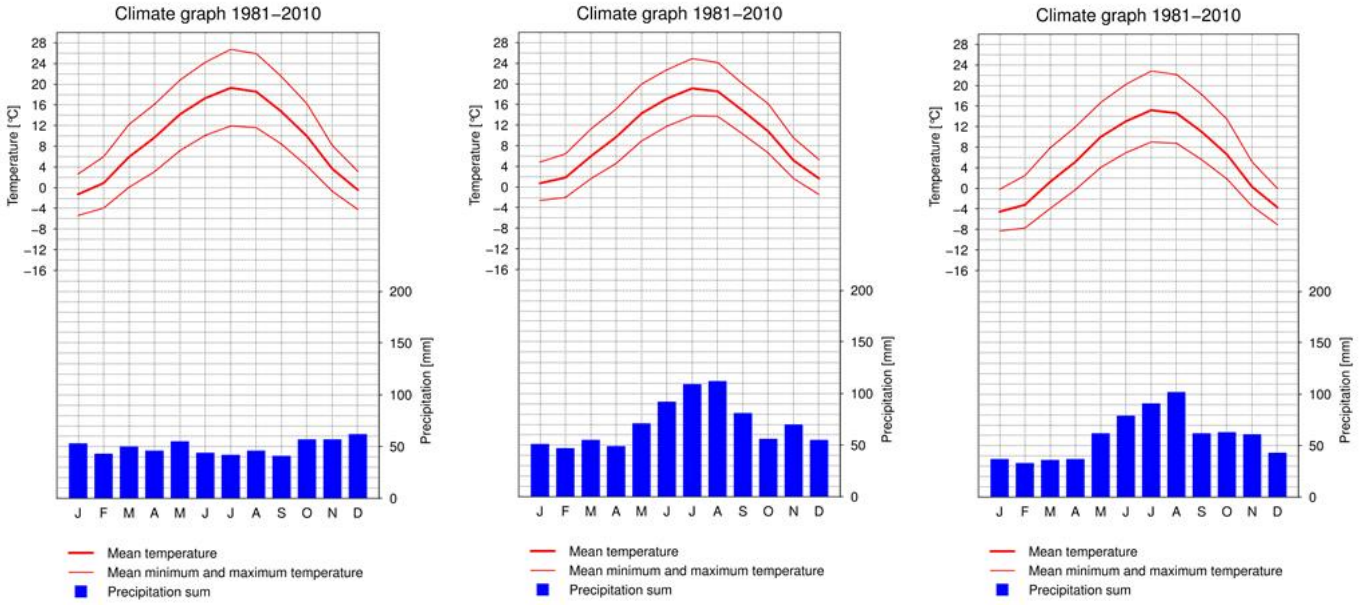

Fig. 2. Climate diagrams of stations in the three studied inneralpine catchments from west to east. MAT = mean annual temperature, Precip. = annual precipitation. Diagrams kindly provided by https://www.meteoschweiz.admin.ch/home/klima/schweizer-klima-im-detail/klima-normwerte/klimadiagramme-und-normwerte-pro-station.html.

tion of the inneralpine relict populations of many species makes them a priority target for the conservation of the European biodiversity. Despite their well-known floristic uniqueness, literature on the vegetation in inneralpine dry valleys in Switzerland is scarce, mostly old and mainly focussed on vegetation classification and the floristic and ecological characterization of the occurring vegetation types (Christ 1879; Frey 1934; Braun-Blanquet 1961), while only few recent studies also analyse biodiversity patterns (Schwabe & Kratochwil 2004; Boch et al. 2019; Dengler 2019b).

Our Field Workshop dealt mainly with the vegetation ascribed to the phytosociological class *Festuco-Brometea* (xeric, meso-xeric, and rocky grasslands), but also included some stands of rocky outcrops (*Sedo-Scleranthetea*). Here we would like to report from the Field Workshop and present some first, preliminary results on species composition (including findings of rare and specialised species), phytodiversity and syntaxonomic position.

The 12th EDGG Field Workshop

The Field Workshop was attended by 16 people, including the organisers, from six European countries (Austria, Germany, Italy, Poland, Switzerland and Ukraine) (Fig. 1). Since several colleagues participated only partially, there were on average 10.75 people present per day.

Our itinerary was a round-trip starting and ending in Wädenswil at Lake Zurich and exploring the Swiss inneralpine valleys from the west to the east (Dengler et al. 2019a). We first sampled the lowest elevations in the Rhône valley and visited the nearly 1000 m higher located sites of the Inn valley (Lower Engadine) at the end, which was important as the phenology in general was quite late in 2019. On the way, we had four different accommodations, most of them for several nights, which allowed us to work effectively also in the evening.

Overall our sampled plots ranged from 46.1219° to 46.9828° northern latitude and from 6.9812° to 10.3765° eastern longitude and extended over more than 1000 m of elevation (500–1,656 m a.s.l.). Bedrocks were very diverse, limestone, granite, metamorphic rocks (gneiss, amphibolite), flysh, moraine and alluvial deposits, while base-rich substrata overall prevailed. In terms of climate, the Rhône valley is the driest and most continental, followed by the Inn valley, while the Rhine valley is the least continental with the highest precipitation (Fig. 2). Regarding our sampling points, annual precipitation varied considerably from as low as 461 mm to more than 1,200 mm (Table 1). It is not surprising that also the mean annual temperature showed a broad range (from 3.2 °C to nearly 11 °C), due to the big differences in elevation, while the three other variables referring to temperature variability hardly did (Table 1).

Table 1. Modelled climatic variables from the locations of the plots, based on the CHELSA database (Karger et al. 2017).

Variable	Min	Max	Mean
Annual mean temperature (Bio1) [°C]	3.2	10.8	7.9
Mean diurnal range of temperature (Bio2) [K]	7.9	8.1	8.0
Temperature seasonality (Bio4) [K]	6.55	6.80	6.70
Temperature annual range (Bio7) [K]	26.9	27.8	27.4
Annual precipitation (Bio12) [mm]	461	1,221	634

We distributed our plots across the three inneralpine valley systems of Switzerland, Rhône, Rhine and Inn, with the aim to capture the full gradient of geographical and ecological differentiation among the occurring *Festuco-Brometea* and *Sedo-Scleranthetea* communities (Figs. 3 and 4). The sites were selected to cover the geographic gradient of the three valley systems as comprehensively and evenly distributed across space as possible within the restricted time. When organising the Field Workshop, we made a pre-selection of suitable sites, mainly based on the online available polygons of protected dry grasslands of national importance (TWW objects; see https://map.geo.admin.ch: TWW and TWW, Anhang 2), which in general present the best preserved and largest dry grassland habitats of the country. This selection was on the one hand sub-setted, on the other complemented with non-protected but interesting sites, mainly based on prior field knowledge of S. Boch, J. Dengler and S. Eggenberg. We excluded only three places where we had enough plot data from other occasions (Ausserberg in the Rhône valley, Sumvitg and Chur in the Rhine valley system). From this initial, larger list of potential sites, we finally sampled those that were possible within the restricted time frame, giving priority to particularly diverse and easily accessible sites. Within the sites, we tried to spread our plots in space and to capture the existing diversity of ecologically and physiognomically different dry grassland types (e.g. meso-xeric vs. xeric, north-facing vs. south-facing slopes). Where rocky outcrop communities (*Sedo-Scleranthetea*) occurred in patches of 10 m² or larger, we specifically included them in our sampling.

In total, we sampled 30 nested-plot series ("EDGG biodiversity plots"; Fig. 5) with grain sizes of 0.0001–100 m² and 82 additional 10-m² plots ("normal plots" in EDGG terminology: Dengler et al. 2016b), resulting in 142 10-m² plots in total when also counting the 10-m² subplots from the nested-plot series (Table 2). We sampled 88 10-m² plots in the Rhône catchment, 18 in the Rhine catchment and 36 in the Inn

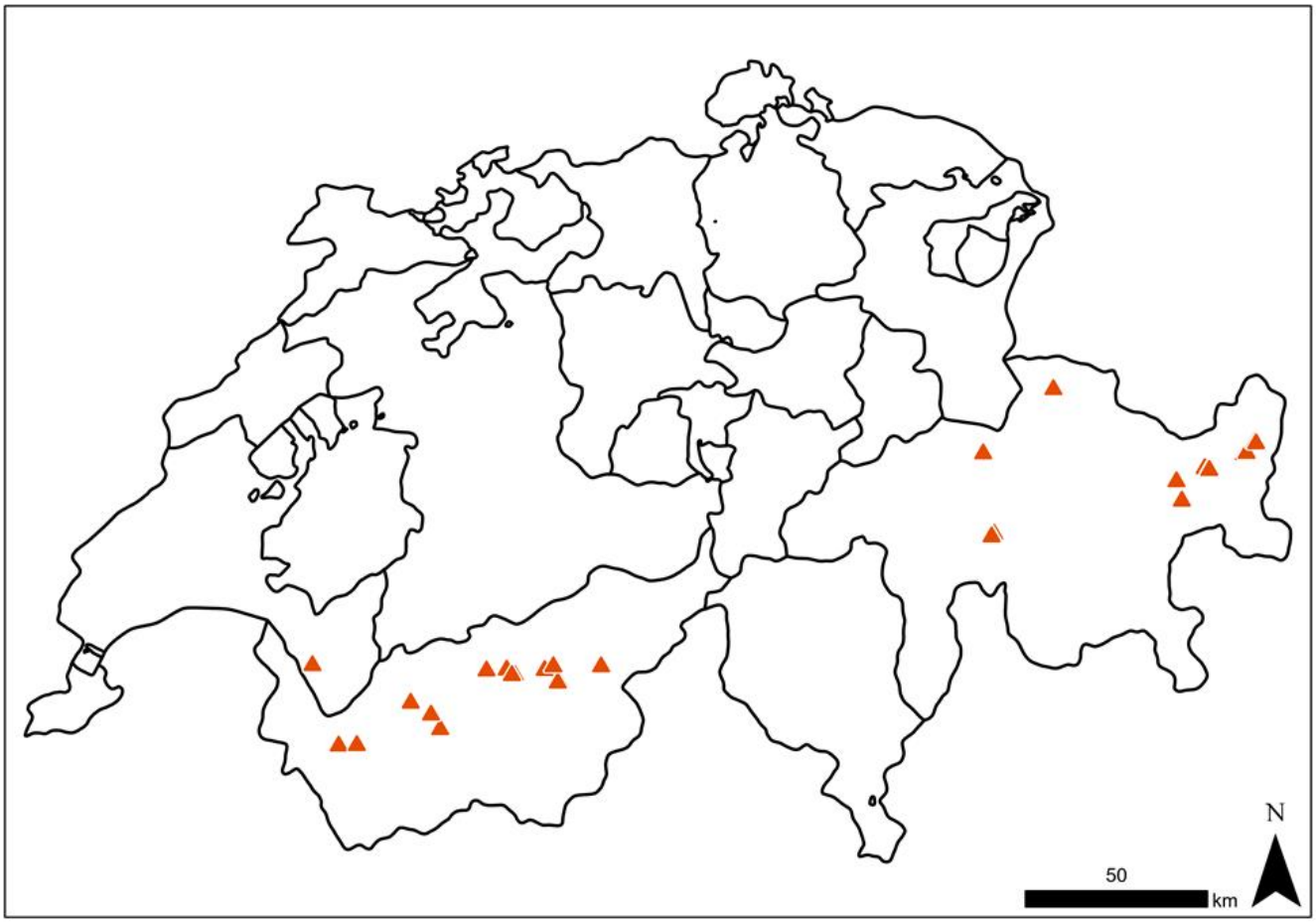

Fig. 3. Distribution of the sampling sites of the 12th EDGG Field Workshop in three cantons of Switzerland. From West to East: Vaud, Valais and Grisons. Map by M. Babbi, copyright geodata: swisstopo DV084370.

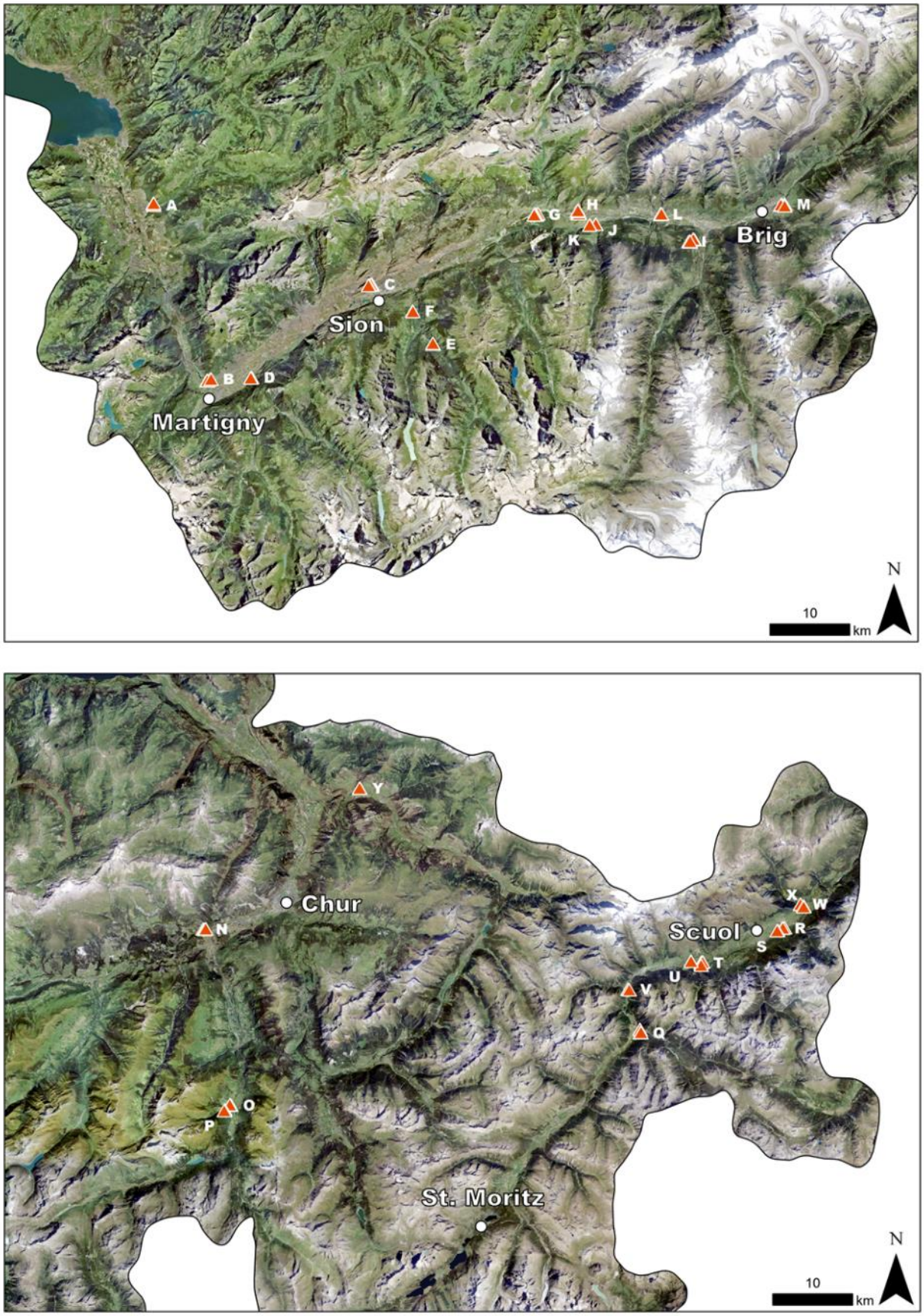

Fig. 4. Sampling sites in the catchments of the Rhône river (upper map: cantons of Vaud and Valais) and those of the Rhine and Inn river (lover map: canton of Grisons), sampled during the first and second part of the Field Workshop, respectively. The background is a full-colour orthophoto, allowing the river systems and different land covers, such as grasslands, forests and barren areas to be distinguished. The letters refer to the site IDs of Table 2 and have been assigned chronologically. Maps by M. Babbi, copyright geodata: swisstopo DV084370.

Fig. 5. Sampling of an EDGG biodiversity plot in the TWW object No. 7003 (Suen-Trogne) in the canton of Valais. Photo: J. Dengler.

catchment. During the seven full and two half days, we studied 25 different sites, with between two and 15 10-m² plots each. In 80% of all sites we made at least one biodiversity plot, while in all but one site we also had additional normal plots. Compared to the previous 11 Field Workshops, we sampled particularly numerous plots, despite a longer survey time for most of them. Only during the 6th (Russia-Khakassia: 39), the 7th (Spain: Navarre: 35), the 9th (Serbia: 32) and the 8th Field Workshops (S Poland: 31) more nested plot series were sampled and only during the 2nd Field Workshop (Ukraine: Podolia: 226) more 10-m² plots were collected (Aćić et al. 2017; unpubl. data from GrassPlot, see Dengler et al. 2018b).

Initial results and discussion

Floristic composition and species of special interest

The most frequent vascular plants (based on the 142 10-m² plots) were *Bromus erectus* (80%), *Potentilla pusilla* (68%), *Artemisia campestris* (51%), *Helianthemum nummularium* subsp. *obscurum* (45%), *Euphorbia cyparissias* (43%), *Carex caryophyllea* (41%) and *Arenaria serpyllifolia* (40%). Some typical species for the different types of dry grasslands are shown in Fig. 6.

Among other grasses, particularly species of the genera *Festuca*, *Stipa*, *Koeleria* and *Poa* are typical, frequent and often dominant in the investigated grasslands, but they contain some "critical" microtaxa. From the *F. ovina* aggr. s.l. (= *F. ovina* aggr. + *F. valesiaca* aggr. sensu Juillerat et al. 2017), the most frequent species was *Festuca valesiaca*, which in most cases could safely be determined in the field (approx. 40% of all 10-m² plots). The identification of the remaining samples is ongoing, but we can already provide a rough picture. Less frequent, but still quite common (ca. 20% of the plots) were *F. rupicola* and *F. laevigata*, while *F. guestfalica* was rarer (ca. 10%). Besides, in the canton of Valais we confirmed *F. pallens* in rocky dry grasslands (see also Dengler et al. 2019b), while in the Lower Engadine, we regularly sampled specimens that likely belong to *F. bauzanina* subsp. *rhaetica*, which was reported from this region before by Arndt (2008), but has not been included to the Swiss checklist of vascular plants (Juillerat et al. 2017) yet. However, the latter needs caryological confirmation as the morphological discrimination against *F. rupicola* and *F. brevipila* is tricky due to significant overlaps in the morphological traits of these related taxa of different ploidy levels. The genus *Stipa* was represented in our plots by three species – most common was *S. eriocaulis* (24%) and less frequently *S. pennata* (12%) and *S. capillata* (9%) occurred. The genus *Koeleria* was also represented by three species: the most common was *K. vallesiana* (29%), slightly less frequent was *K. macrantha* (22%), whilst *K. pyramidata* occurred only in three plots (including two corners of one biodiversity plot). From the genus *Poa*, the most frequent species was *P. bulb-*

Table 2. Overview of the dry-grassland sites studied during the 12th EDGG Field Workshop 2019. Most sites belong to the protected dry grasslands of national importance (TWW objects). In this case the object ID and name are indicated.

Site ID	Day	Valley (catchment)	Canton	Municipality	Name of the site	# Biodiversity plots	# Normal plots	Total # 10-m²
A	11 May	Rhône	Vaud	Aigle, Ley-	TWW object No.6210 (Drapel)	-	3	3
B	12 May	Rhône	Valais	Dorénaz, Fully	TWW object No. 7550 (Les Follatères)	3	9	15
C	13 May	Rhône	Valais	Vex	TWW object No. 7150 (Mont d'Orge)	3	5	11
D	13 May	Rhône	Valais	Charrat	TWW object No. 7588 (Charrat	1	2	4
E	13 May	Borgne	Valais	Saint-	TWW object No. 7003 (Suen-	1	2	4
F	13 May	Borgne (Rhône)	Valais	Vex	Near TWW object No. 7158 (Les Bioleys)	-	2	2
G	14 May	Rhône	Valais	Leuk	Regional Nature Park Pfyn-Finges: alluvial steppe near Tur-	2	4	8
H	14 May	Rhône	Valais	Leuk	TWW object No. 7211 (Ober	2	9	13
I	15 May	Rhône	Valais	Zeneggen	TWW object No. 7078 (Alt Ze-neggen)	2	6	10
J	15 May	Rhône	Valais	Turtmann-Unterems	TWW object No. 7071 (Chrizhubel)	1	1	3
K	15 May	Rhône	Valais	Turtmann-	Chastlärä	-	3	3
L	15 May	Rhône	Valais	Raron	TWW object No. 7063 (Heidnischbiel)	1	3	5
M	16 May	Rhône	Valais	Ried-Brig	TWW object No. 7124 (Biela)	2	3	7
N	16 May	Rhine Anterior	Grisons	Tamins	TWW object No. 8157 (Fatschis)	1	3	5
O	17 May	Rhine Posterior	Grisons	Donat	TWW object No. 9883 (Bot Git)	2	1	5
P	17 May	Rhine Posterior	Grisons	Casti-Wergen-	TWW object No. 9890 (Casti)	-	4	4
Q	17 May	Spöl (Inn)	Grisons	Zernez	TWW object No. 9817 (Muottas)	2	2	6
R	18 May	Inn	Grisons	Scuol	TWW object No. 9133 (Marièrs)	1	3	5
S	18 May	Inn	Grisons	Scuol	TWW object No. 9181 (Suronnas)	1	2	4
T	18 May	Inn	Grisons	Scuol	TWW object No. 9768 (Chastè	1	8	10
U	18 May	Inn	Grisons	Scuol	TWW object No. 9787 (Flanoua)	1	-	2
V	18 May	Inn	Grisons	Zernez	TWW object No. 9811 (Chaschinas)	-	2	2
W	19 May	Inn	Grisons	Valsot	TWW object No. 9108 (Chantata)	1	1	3
X	19 May	Inn	Grisons	Valsot	TWW object No. 9735 (Ruina	1	2	4
Y	19 May	Landquart (Rhine)	Grisons	Grüsch	TWW object No. 8840 (Munts)	1	2	4

Fig. 6. A selection of characteristic vascular plant species of the Swiss inneralpine dry valleys. From upper left to lower right: *Trifolium montanum*, typical for meso-xeric grasslands, *Pulsatilla montana*, typical for xeric grasslands, *Scorzonera austriaca*, typical for rocky grasslands, *Sempervivum arachnoideum*, typical for rocky outcrop communities. Photos: J. Dengler.

osa (30%), followed by *P. angustifolia* (27%), while also *P. perconcinna* (10%) and *P. badensis* (9%) regularly occurred, but *P. alpina*, *P. chaixii*, *P. compressa* and *P. pratensis* were rare.

Interestingly, and in contrast to the distribution patterns reported in Lauber et al. (2018) we only found *Brachypodium rupestre* from the *Brachypodium pinnatum* aggregate, never *Brachypodium pinnatum* s.str. Likewise, we only found *Potentilla pusilla* (68%), but never *Potentilla verna*, and only very rarely *Potentilla cinerea* (1%). This indicates that many botanists did not and still do not distinguish these microspecies and erroneously record *Brachypodium pinnatum* for *Brachypodium pinnatum* aggr. and *Potentilla verna* for *Potentilla verna* aggr. Based on our experience, records of *Brachypodium pinnatum* s.str. and *Potentilla verna* s.str. from the inneralpine dry valleys of Switzerland should be critically revised. These clear patterns of vicariance might also have syntaxonomic implications (see below).

The most frequent bryophyte species (based on 69 normal plots) were *Abietinella abietina* (36%), *Syntrichia ruralis* (29%), *Bryum caespiticium* (26%), *Weissia brachycarpa* (26%), *Phascum cuspidatum* (23%) and *Bryum argenteum* (20%) (see Fig. 7). In the investigated dry grasslands 61 moss taxa were noted. Among them ground mosses of the *Pottiaceae* family predominated (e.g. *Barbula unguiculata*, *Didymodon rigidulus*, *Syntrichia ruralis*, *S. intermedia*, *Phascum cuspidatum*, *Weissia brachycarpa* and *W. longifolia*). They are perfectly adapted to high temperatures and high sunlight due to their papillary leaves. Common mosses like *Bryum argenteum*, *Ceratodon conicus* and *C. purpureus* also frequently occurred on bare ground and plant debris. On basic sites, typical mosses of base-rich grasslands were found: *Abietinella abietina*, *Campyliadelphus chrysophyllus*, *Encalypta vulgaris*, *Homalothecium lutescens*, *Rhytidium rugosum*, *Tortella tortuosa* and *Timmia norvegica.* On rocky ground (gravel, stones, sometimes margins of rocks) *Grimmia laevigata*, *G. pulvinata*, *Hedwigia ciliata*, *Orthotrichum anomalum*, *Schistidium apocarpum* and *S. atrofuscum* were noted. During our study, liverworts were much less frequently recorded than mosses: we found in total only eight species; among them the most common were *Athalamia hyalina*, *Riccia glauca*, *Cephaloziella divaricata* and *Porella platyphylla.*

The most frequent lichen species (based on the 142 10-m² plots) were *Cladonia pocillum* (14%), *C. symphycarpia* (13%), *Placidium squamulosum* (11%) and *Toninia sedifolia* (10%),

Fig. 7. A selection of characteristic non-vascular species of the Swiss inneralpine dry valleys. Upper row left: the liverwort *Targionia hypophylla*, right: the moss *Rhytidium rugosum*, lower row left: *Diploschistes muscorum* and *Squamarina lentigera,* right: *Cladonia* sp., *Fulgensia* cf. *bracteata, Squamarina lentigera, Toninia sedifolia*. Photos: J. Dengler.

indicating mostly calcareous or at least base-rich soil conditions (see Fig. 7). In general, lichens in grasslands need open conditions with little competition, providing suitable microhabitats within the scattered vegetation (Boch et al. 2016). Regarding the distribution patterns across Switzerland, we found several species which specialise on the dry, warm and sunny conditions of the investigated dry grasslands in the inneralpine dry valleys (Stofer et al. 2019). Among these, *Caloplaca raesaenenii*, *C. stillicidiorum* and *Candelariella aggregata* grow on dead plant material in steppe grasslands, such as the persistent leaf sheaths of *Koeleria vallesiana*, whereas *Enchylium coccophorum*, *Endocarpon pallidum*, *E. pusillum*, *Gyalidea asteriscus*, *Heppia adglutinata*, *Leptochidium albociliatum* and *Rinodina terrestris* grow directly on soil. All these species are small to very small and therefore likely frequently overlooked, probably explaining the rather few known localities in Switzerland.

Phytodiversity

Apart from three biodiversity plots in Dengler et al. (2019b), we now for the first time describe in detail the scale- and taxon-dependent plant diversity patterns in dry grasslands of the Swiss inneralpine valleys (Table 3) and thus allow comparisons with similar data from elsewhere in the Palaearctic (e.g. Dengler et al. 2016a). Mean vascular plant species richness increased from 2.0 species on 0.0001 m², via 17.5 on 1 m², 28.9 on 10 m², to 47.3 on 100 m². This is lower than the values found in any of the previous EDGG Field Workshop studying the dry grasslands of a region with the same method (except for 0.0001 m², where the values in Serbia and Sicily were slightly lower) (Dengler et al. 2016a; Aćić et al. 2017; Filibeck et al. 2018; Magnes et al. 2020). For example, for the 10-m² grain, the so far lowest regional average was from Serbia (30.9 species), while the highest mean values were 49.7 in Transylvania (Romania), 49.5 in the Apennines (Italy) and 41.9 in Navarre (Spain) (Dengler et al. 2016a; Aćić et al. 2017; Filibeck et al. 2018). Preliminary averages of *Festuco-Brometea* grasslands across the Palaearctic realm were also clearly higher across all scales than the values from the Swiss inneralpine valleys, with 2.3 on 0.0001 m², 21.0 on 1 m², 34.9 on 10 m² and 54.1 on 100 m² (Dengler et al. 2018a). Comparably "low" vascular plant species richness in dry grasslands was found so far only (outside EDGG Field Workshops) in the Aosta valley (an extreme inneralpine valley of NW Italy, running parallel to the Rhône valley in Valais: 27.8 species on 10 m²: Wiesner et al. 2015), while the values on the hemiboreal islands of Öland and Saaremaa (24.2 and 24.0) and in the Pleistocene lowlands of NE Germany (19.8) were even lower (see Dengler et al. 2016a). Compared to most other habitats in Switzerland, dry grasslands are still particularly species rich. Thus, it is challenging to understand why their richness is lower across all scales when compared to dry grasslands elsewhere in Europe. One explanation might be that the Swiss inneralpine valleys, like Aosta valley, the hemiboreal zone and NE Germany, were all covered by glaciers during the last glacial maximum, while all the other regions studied by EDGG Field Workshops were not. This glaciation could have impacted the regional species pool and this in turn the plot-scale richness. To solve this riddle in detail, however, will require a joint analysis of α-diversity patterns across the Palaearctic realm, which is currently in preparation with the GrassPlot data (I. Dembicz et al. in prep.). For non-vascular plants, the pattern is different. While the identification is not yet completely finalised and thus the richness data might slightly change, it is already clear that mean richness in the Swiss inneralpine valleys is at an intermediate level compared to other regions. With about 5.5 non-vascular species on 10 m², the stands were on average richer than in Transylvania (3.1) or Podolia (3.9), but poorer than in Sicily (7.0) or Navarre (6.5).

Syntaxonomy

Our field impressions confirmed that the *Festuco-Brometea* communities of the Swiss inneralpine dry valleys belong to three major groups: meso-xeric, xeric and rocky grasslands. We could confirm this pattern, which had been elaborated for Ausserberg, Valais, by Dengler et al. (2019b), throughout the study region. These three main types correspond to habitat types of the refined European EUNIS typology (Janssen et al. 2016; Schaminée et al. 2016), namely E1.2a – Semi-dry perennial calcareous grassland (meso-xeric), E1.2b – Continental dry steppe (xeric) and E1.1g – Perennial rocky grassland of Central Europe and the Carpathians (rocky). They also correspond to three phytosociological orders of the *Festuco-Brometea* that have been accepted in nearly all recent broad-scale studies of the class (e.g. Mucina et al. 2016; Willner et al. 2017, 2019): *Brachypodietalia pinnati* (meso-xeric), *Festucetalia valesiacae* (xeric) and *Stipo pulcherrimae-Festucetalia pallentis* (rocky). However, they con-

Table 3. Preliminary species richness data from the 12th EDGG Field Workshop in Switzerland.

		Total richness		Vascular plants		Bryophytes		Lichens	
Area [m²]	*n*	Mean	Range	Mean	Range	Mean	Range	Mean	Range
0.0001	60	2.3	0–5	2.0	0–5	0.2	0–2	0.1	0–1
0.001	60	3.6	0–8	3.0	0–8	0.4	0–3	0.1	0–3
0.01	60	6.2	0–14	5.2	0–11	0.8	0–4	0.3	0–6
0.1	60	12.0	5–24	10.1	3–20	1.4	0–5	0.5	0–7
1	60	20.7	10–33	17.5	5–30	2.1	0–7	1.1	0–8
10	142	34.4	9–60	28.9	7–49	3.3	0–12	2.2	0–23
100	30	58.3	29–84	47.3	17–69	6.2	0–16	4.6	0–25

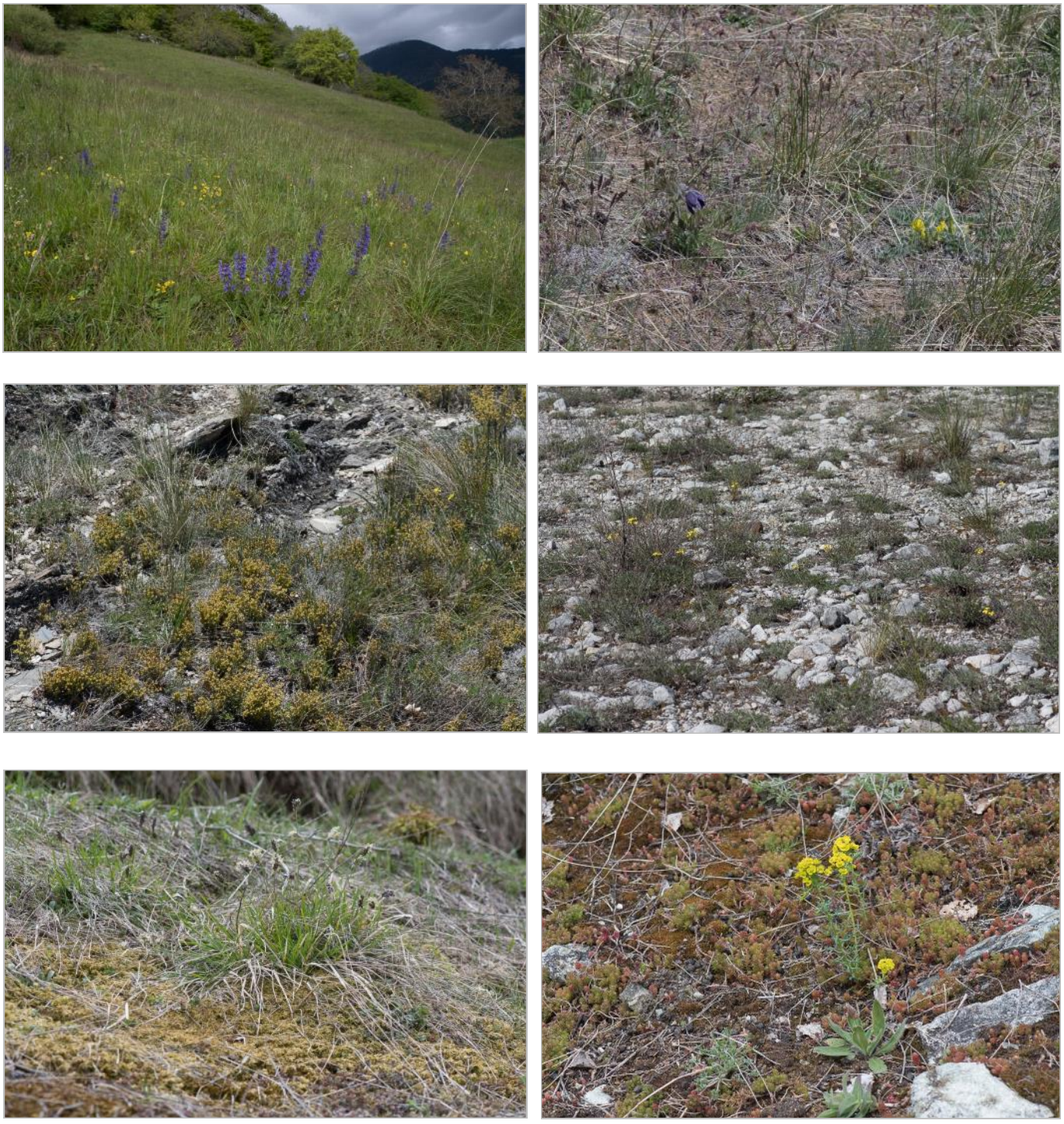

Fig. 8. Examples of the main vegetation types studied. Upper row left: meso-xeric grassland with *Salvia pratensis*, Drapel, Valais, right: xeric grassland with *Pulsatilla montana* and *Astragalus exscapus*, Alt Zerneggen, Valais; middle row left: rocky grassland with *Ephedra helvetica* and *Stipa eriocaulis*, Mont d'Orge, Valais, right: special type of rocky grassland in the alluvial plain of the Rhône river with *Erysimum rhaeticum* and *Stipa eriocaulis*, near Turriljini, Valais; lower row left: dealpine *Sesleria caerulea* grassland with dense *Hylocomium splendens* carpet, Chastè Steinsberg, Grisons, right: rocky outcrop community with *Sedum sexangulare*, *S. maximum*, *Euphorbia cyparissias*, *Artemisia campestris* and *Echium vulgare*, Muottas, Grisons. For further information on the sites, see Table 2. Photos: J. Dengler.

trast with the Swiss habitat typology in which the xeric and rocky types are merged into a single unit at alliance level ("*Stipo-Poion*"; Delarze et al. 2015). Following the typification of the *Stipo-Poion xerophilae* by Dengler et al. (2019b), this name would apply to the rocky grassland alliance, while the xeric, non-rocky grasslands of the Swiss inneralpine valleys seem to belong to the Eastern European *Festucion valesiacae*.

While the visual impression in the field supported the view that these three orders are present and well distinguished throughout the study region, there are major questions concerning their placement into alliances. Following the traditional and well-elaborated subdivision between the subatlantic *Bromion erecti* and the subcontinental *Cirsio-Brachypodion pinnati* (e.g. Willner et al. 2019), it was evident based on the species combination that the huge majority of the meso-xeric stands in the region should be placed in the *Cirsio-Brachypodion pinnati* and only for the stands in the more oceanic parts (lower Rhône valley in canton of Vaud, Rhine valley and tributaries) placement in the *Bromion erecti* would be plausible. However, our expedition also gave rise to another idea: a separate alliance of the meso-xeric grasslands of the inneralpine dry valleys and the dealpine gravel plains (e.g. in Southern Germany). This idea was prompted by the fact that all investigated stands differed from both the *Bromion erecti* and the *Cirsio-Brachypodion pinnati* (as defined e.g. by Willner et al. 2019) in the frequent presence of two species that are absent from both other alliances, *Brachypodium rupestre* and *Potentilla pusilla*. Moreover, these inneralpine meso-xeric grasslands harbor fewer species than the meso-xeric grasslands outside the Alps. It will be an interesting task to analyse whether it makes sense to delimit an additional inneralpine and dealpine alliance within the meso-xeric order *Brachypodietalia pinnati*.

We also found some *Sesleria caerulea* grasslands without other alpine species (see Fig. 8). Accordingly, they can hardly be placed in the class *Elyno-Seslerietea*. Therefore, one might consider placing them into the order *Stipo pulcherrimae-Festucetalia pallentis* (rocky grasslands), and within this possibly the alliance *Diantho lumnitzeri-Seslerion* (see Mucina et al. 2016).

Finally, the rocky outcrop communities of the class *Sedo-Scleranthetea* are also a challenge. Both Mucina et al. (2016) and Delarze et al. (2015) distinguish three alliances for the region: *Sedo albi-Veronicion dillenii* (acidophilous, lowlands), *Sedo-Scleranthion* (acidophilous, Alps) and *Alysso alyssoidis-Sedion* (basiphilous). While typical species of these alliances and the *Sedo-Scleranthetea* class often also occur as small-scale synusiae in xeric and rocky grasslands of the orders *Festucetalia valesiacae* and *Stipo pulcherrimae-Festucetalia pallentis*, they can indeed be found to form larger stands of 10 m² and more. However, from our field impressions it appears doubtful whether really three alliances can be distinguished as in the region the given diagnostic species often grow together. A detailed analysis of the data will be needed to solve this issue.

Conclusions and outlook

We plan to finalise the identification of the remaining critical vascular plant, bryophyte and lichen species during the next few weeks. In parallel the soil samples will be analysed for some major parameters according to EDGG standards (Dengler et al. 2016b). Once these steps are completed, we intend to use our comprehensive dataset to prepare two publications, one on syntaxonomy of the studied dry grasslands and one on biodiversity patterns and their drivers. Where appropriate, we will include some additional plots sampled by J. Dengler and his team recently in the inneralpine dry valleys of Switzerland with similar methods, albeit not always with soil and cryptogam data. Additional "EDGG biodiversity plots" and 10-m^2 plots are available from Ausserberg, Valais (2018; published in Dengler et al. 2019b) as well as some more normal plots from Ausserberg, Valais (2019; CAS class: J. Dengler & M. Babbi); Chur, Grisons (2018; research project "Calanda Zielhang": M. Babbi, S. Widmer & J. Dengler) and Sumvitg-Cumpadials (2019; BSc class: J. Dengler).

As soon as the vegetation data are ready, they will also be integrated in the GrassPlot database (Dengler et al. 2018b; Biurrun et al. 2019) and the emerging Swiss national vegetation database ("Veg.CH") and via these in the European Vegetation Archive (EVA; Chytrý et al. 2016) and the global plot database "sPlot" (Bruelheide et al. 2019) to allow the best possible use. Moreover, the floristic information will be fed into the database of the National Data and Information Center on the Swiss Flora ("Info Flora"; https://www.infoflora.ch), bryophytes ("Swissbryophytes"; https://www.swissbryophytes.ch/) and lichens ("Swisslichens"; Stofer et al. 2019).

The notable value of the data from the Field Workshop is to provide the basis for implementing the pan-European dry grassland classification to Switzerland and to see whether based on proper data analysis our first impressions from the field are confirmed. The data can also lead to a refinement of the European classification that was hitherto lacking data from Switzerland. For example, it now can be tested where to draw the border between *Bromion erecti* and *Cirsio-Brachypodion* within the meso-xeric grasslands (*Brachypodietalia pinnati*) or whether even a new vicariant alliance could make sense. Further it could be tested whether the distinction of rocky (*Stipo-Poion xerophilae* s.str.) vs. xeric, non-rocky (*Festucion valesiacae*) grasslands as known from Eastern Central Europe and demonstrated for Ausserberg, Valais (Dengler et al. 2019b), should be applied throughout Switzerland. Also the numerous high-quality data of biodiversity in Swiss inneralpine dry grasslands are interesting as they show much lower richness across all scales for vascular plants, but relatively high richness for non-vascular plants compared to other regions in Europe.

These data will thus be a major input when developing models of patterns and drivers of scale- and taxon-dependent plant diversity of grasslands across the Palaearctic biogeographic realm (Dengler et al. 2018b, 2020).

Author contributions

J.D. organised the Field Workshop with logistic support from J.G. As past and current EDGG Field Workshop Coordinators, J.D. and I.D. ensured the application of the EDGG standard methodology. All co-authors except S.B. helped with the field sampling. I.D. identified critical *Festuca* species, B.C.-M. identified bryophytes and S.B. identified lichens. J.D. drafted the report together with I.D. and R.G., M.B. prepared the maps, while R.G., I.M. and D.V. composed the photo diary. All authors checked, improved and approved the manuscript.

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References

Aćić, S., Dengler, J., Biurrun, I., Becker, T., Becker, U., Berastegi, A., Boch, S., Dembicz, I., García-Mijangos, I., (…) & Dajić Stevanović, Z. 2017. Biodiversity patterns of dry grasslands at the meeting point of Central Europe and the Balkans: Impressions and first results from the 9th EDGG Field Workshop in Serbia. *Bulletin of the Eurasian Dry Grassland Group* 34: 19–31.

Arndt, S. 2008. Novelties in the *Festuca valesiaca* group (*Poaceae*) from the central Alps. *Plant Systematics and Evolution* 271: 129–142.

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.

Boch, S., Bedolla, A., Ecker, K.T., Ginzler, C., Graf, U., Küchler, H., Küchler, M., Nobis, M.P., Holderegger, R. & Bergamini, A. 2019. Threatened and specialist species suffer from increased wood cover and productivity in Swiss steppes. *Flora* 258: Article 151444.

Boch, S., Prati, D., Schöning, I. & Fischer, M. 2016. Lichen species richness is highest in non-intensively used grasslands promoting suitable microhabitats and low vascular plant competition. *Biodiversity and Conservation* 25: 225–238.

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

Bruelheide, H., Dengler, J., Jiménez-Alfaro, B., Purschke, O., Hennekens, S.M., Chytrý M., Pillar, V.D., Jansen, F., Kattge, J., (…) & Zverev, A. 2019. sPlot – a new tool for global vegetation analyses. *Journal of Vegetation Science* 30: 161–186.

Christ, H. 1879. *Das Pflanzenleben der Schweiz*. Schulthess, Zurich, CH.

Chytrý, M., Hennekens, S.M., Jiménez-Alfaro, B., Knollová, I., Dengler, J., Jansen, F., Landucci, F., Schaminée, J.H.J., Aćić, S., (…) & Yamalov, S. 2016. European Vegetation Archive (EVA): an integrated database of European vegetation plots. *Applied Vegetation Science* 19: 173–180.

Delarze, R., Gonseth, Y., Eggenberg, S. & Vust, M. 2015. *Lebensräume der Schweiz. Ökologie – Gefährdung – Kennarten*. 3rd ed. Ott, Bern, CH.

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

Dengler, J., Boch, S., Filibeck, G., Chiarucci, A., Dembicz, I., Guarino, R., Henneberg, B., Janišová, M., Marcenò, C., (…) & Biurrun, I. 2016b. 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., Conradi, T., Dembicz, I., Guarino, R., Naqinezhad, A. & GrassPlot Consortium 2018a. *EDGG Field Workshops and the GrassPlot database: new opportunities to understand scale-dependent biodiversity patterns in Palaearctic grasslands*. Oral presentation at the 15th Eurasian Grassland Conference of the EDGG, Sulmona, Italy, 4–8 June 2018. DOI: 10.13140/RG.2.2.27660.56969.

Dengler, J., Wagner. V., Dembicz, I., García-Mijangos, I., Naqinezhad, A., Boch, S. Chiarucci, A., Conradi, T., Filibeck, G., (…) & Biurrun, I. 2018b. 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. 2019a. EDGG Field Workshops 2019 – the international research expeditions to study grassland diversity across multiple scales and taxa: Call for participation. *Palaearctic Grasslands* 41: 9–22.

Dengler, J., Widmer, S., Staubli, E., Babbi, M., Gehler, J., Hepenstrick, D., Bergamini, A., Billeter, R., Boch, R., (…) & Dembicz, I. 2019b. Dry grasslands of the central valleys of the Alps from a European perspective: the example of Ausserberg (Valais, Switzerland). *Hacquetia* 18: 155–177.

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

Filibeck, G., Cancellieri, L., Sperandii, M.G., Belonovskaya, E., Sobolev, N., Tsarevskaya, N., Becker, T., Berastegi, A., Bückle, C., (…) & Biurrun, I. 2018. Biodiversity patterns of dry grasslands in the Central Apennines (Italy) along a precipitation gradient: experiences from the 10th EDGG Field Workshop. *Bulletin of the Eurasian Grassland Group* 36: 25–41.

Frey, H., 1934. *Die Walliser Felsensteppe*. PhD thesis, University of Zurich, Zurich, CH.

Janssen, J.A.M., Rodwell, J.S., Garcia Criado, M., Gubbay, S., Haynes, T., Nieto, A., Sanders, N., Landucci, F., Loidi, J., (…) & Valachovič, M. 2016. *European Red List of Habitats – Part 2. Terrestrial and freshwater habitats*. European Union, Luxembourg, LU.

Juillerat, P., Bäumler, B, Bornand, C., Eggenberg, S., Gygax, A., Jutzi, M., Möhl, A., Nyffeler, R., Sager, L. & Santiago, H. 2017. *Flora Helvetica Checklist 2017 der Gefässpflanzenflora der Schweiz*. Info Flora, Bern, CH.

Karger, D.N., Conrad, O., Böhner, J., Kawohl, T., Kreft, H., Soria-Auza, R.W., Zimmermann, N.E., Linder, H.P. & Kessler, M. 2017. Climatologies at high resolution for the earth's land surface areas. *Scientific Data* 4: Article 170122.

Lauber, K., Wagner, G. & Gygax, A. 2018. *Flora Helvetica – Illustrierte Flora der Schweiz*. 6th ed. Haupt, Bern, CH.

Magnes, M., Kirschner, P., Janišová, M., Mayrhofer, H., Berg, C., Mora, A., Afif, E., Willner, W., Belonovskaya, E., (…) & Dengler, J. 2020. 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. *Palaearctic Grasslands* 45: 34–58.

Meier, M.K., Urmi, E., Schnyder, N., Bergamini, A. & Hoffmann, H. 2013. *Checkliste der Schweizer Moose. Stand: 14.10.2013*. Nationales Inventar der Schweizer Moosflora & Institut für Systematische Botanik der Universität Zürich, Zurich, CH.

Mucina, L., Bültmann, H., Dierßen, K., Theurillat, J.-P., Raus, T., Čarni, A., Šumberová, K., Willner, W., Dengler, J., (…) & Tichý, L. 2016. Vegetation of Europe: Hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. *Applied Vegetation Science* 19, Supplement 1: 3−264.

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.

Schaminée, J.H.J., Chytrý, M., Dengler, J., Hennekens, S.M., Janssen, J.A.M., Jiménez-Alfaro, B., Knollová, I., Landucci, F., Marcenò, C., (…) & Tichý, L. 2016. *Development of distribution maps of grassland habitats of EUNIS habitat classification*. European Environment Agency [Report EEA/NSS/16/005], Copenhagen, DK.

Schwabe, A. & Kratochwil, A. 2004. *Festucetalia valesiacae* communities and xerothermic vegetation complexes in the Central Alps related to environmental factors. *Phytocoenologia* 34: 329–446.

Stofer, S., Scheidegger, C., Clerc, P., Dietrich, M., Frei, M., Groner, U., Jakob, P., Keller, C., Roth, I., (…) & Zimmermann, E. 2019. *SwissLichens − Webatlas der Flechten der Schweiz / Modul Verbreitung (Version 2)*. URL: http://www.swisslichens.ch [accessed on 10 January 2019].

Vrahnakis, M.S., Janišová, M., Rūsiņa, S., Török, P., Venn, S. & Dengler, J. 2013. The European Dry Grassland Group (EDGG): stewarding Europe's most diverse habitat type. In: Baumbach, H. & Pfützenreuter, S. (eds.) *Steppenlebensräume Europas – Gefährdung, Erhaltungsmaßnahmen und Schutz*, pp. 417–434. Thüringer Ministerium für Landwirtschaft, Forsten, Umwelt und Naturschutz, Erfurt, DE.

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.

Willner, W., Kuzemko, A., Dengler, J., Chytrý, M., Bauer, N., Becker, T., Biţă-Nicolae, C., Botta-Dukát, Z., Čarni, A., (…) & Janišová, M. 2017. A higher-level classification of the Pannonian and western Pontic steppe grasslands (Central and Eastern Europe). *Applied Vegetation Science* 20: 143−158.

Willner, W., Roleček, J., Korolyuk, A., Dengler, J., Chytrý, M., Janišová, M., Lengyel, A., Aćić, S., Becker, T., (…) & Yamalov, S. 2019. Formalized classification of the semi-dry grasslands of central and eastern Europe. *Preslia* 91: 25–49.

Appendix: Photo diary of the 12th EDGG Field Workshop

Edited by Riccardo Guarino, Ivan Moysiyenko & Denys Vynokurov
Photos by Beata Cykowska-Marzencka, Iwona Dembicz, Jürgen Dengler, Ivan Moysiyenko, Denys Vynokurov & Wolfgang Willner

Here, we present some photographs to remind you that the EDGG Field Workshops are more than just data collection. We are all the result of the experiences we have, of what we believe in and also of the people we meet. Each of us grows thanks to the people we walk with. Some remain, many follow different directions, many are about to be met. Each of them leaves us something, giving us a piece of our mosaic.

A piece of advice, a memory, a series of experiences, sometimes just a sentence, a smile or even... a plant identification! We are also made of this, of those who have shared with us a short stretch of the road.

There are those who are connected to our life by something more than a common path, but with others, especially if we did a vegetation plot together, we have not lost our time.

Day 1 (May 11, 2019)

We met in Wädenswil in the Canton of Zurich, at the castle Schloss Wädenswil (the seat of the Vegetation Ecology Group, ZHAW Zurich University of Applied Sciences). In the early afternoon, we travelled to our first sampling locality, near Aigle village (Canton of Vaud), which is famous for its white wines. There we sampled *Bromus erectus* grasslands. In the evening, we stayed in the cosy youth hostel of Sion, the capital of the canton of Valais.

Lunch at a gas station on the way to the Alps.

Alps greeted us with a rain.


Left: Sometimes we looked like shepherds - right: species-rich semi-dry grasslands in the vicinity of Aigle village.


Left: sampling process - right: typical landscape with dry grasslands and forests near the village of Aigle.


Left: The southern slopes are almost entirely covered with vineyards - right: stimulation of the identification process.

Day 2 (May 12, 2019)
Our second sampling site was the Natural Reserve Les Follatères, near Martigny, in the valley of the Rhône River. This site is characterized by high continentality and by steep south-facing slopes with co-occurrent relict steppic species like *Euphorbia seguieriana*, *Adonis vernalis*, *Stachys recta* and sub-Mediterranean xero-thermophilous species like *Alyssoides utriculata*, *Orlaya grandiflora*, *Saponaria ocymoides*. During this day, our group was joined by Stefan Eggenberg, the main author of the renowned works "Flora Vegetativa" and "Flora Helvetica".

The first biodiversity plot.

Sampling dry grasslands in Les Follatères Reserve.

Left: some military fortifications - right: excursion led by S. Eggenberg.

Day 3 (May 13, 2019)
On the third day, we sampled in different localities: the first was near Sion, on the Mont d'Orge hill. Here we were introduced to many species whose epithets came after the name of the Valais Valley – *Artemisia vallesiaca*, *Festuca valesiaca, Centaurea valesiaca*, *Koeleria vallesiana*. After the lunch near the ruins of Montorge Castle, our next destination was moraine slopes near the village St. Martin. Here, a part of our team sampled dry and semi-dry grazed grasslands dominated by *Bromus erectus*, *Festuca valesiaca* and *Stipa capillata*, at an elevation of about 1,000 m a.s.l. The other group sampled dry grasslands near the village of Charat-Vison. On the way home, we stopped for some relevés in semi-dry grasslands near the village of Vex.


Left: Sion castles - right: Valais Valley.


Left: *Ephedra distachya* subsp. *helvetica* - right: orchids, among others *Orchis morio*, are quite common in semi-dry to dry grasslands.


Left: moraine slopes near St. Martin village - right: the village of Luette.

Evening species identification.

Day 4 (May 14, 2019)
In the morning, we visited Pfyn-Finges Nature Park. After a short introduction on the creation of the park and its many projects, we sampled alluvial steppe on cleared stony areas of the floodplain of the Rhône River. Here we had the poorest plot in our expedition – 9 species per 10 m^2. This site is memorable for one more attractive species named after the Valais Valley: *Matthiola valesiaca*.
After having lunch near the scenic Feschilju Gorge, we sampled rocky steppes on the not less gorgeous southern slopes of the Valais Valley, near the Leuk municipality with the snow-capped mountains on the horizon. Here we met *Stipa eriocaulis*, *Festuca valesiaca* and *Poa perconcinna* dominated communities. In the evening, we arrived at our second accommodation: Hotel Olympica in Brig.

Above: Introductory meeting with Evelyne Oberhummer from the Regional Natural Park Pfyn-Finges - below: sampling in the floodplain of the Rhône River.


Left: an old bridge under the Feschilju Gorge, Leuk - right: *Stipa eriocaulis*-dominated grasslands.


Left: rocky dry grassland near Leuk - right: sampling the community with *Poa perconcinna.*


Left: the impressive Valais valley - right: drying soil samples and cryptogams.

Day 5 (May 15, 2019)

During the fifth day, we continued moving eastward along the Valais Valley. In the morning we climbed one of the highest localities in our expedition – near Zeneggen (around 1500 m a.s.l.). This place is famous for a population of *Astragalus exscapus*, which is preserved here very well. We were guided by the owner of the nice grasslands that we sampled. After lunch, we recorded relevés near Leuk, Raron and Turtmann along the characteristic "Adonis path", in beautiful grasslands full of *Adonis vernalis* in full bloom.

One of the highest localities in our expedition – near Zeneggen.

Left: working in the morning near Zeneggen - right: being in nature always gives one a good appetite, especially after work.

Left: observing animal taxa, such as grasshoppers ☺ - right: short break before sampling.

Xerothermic vegetation with *Stipa pennata* aggr. (above) and *Adonis vernalis* (below).

Day 6 (May 16, 2019)
In the morning, we did our last stop for sampling in the Valais Valley, in the nature reserve of cantonal importance Achera-Biela near Brig-Glis town. Later we moved via the high mountain pass "Oberalp" (elevation 2,044 m a.s.l.) to the Canton of Grisons. In the late afternoon we sampled semi-dry grasslands of the protected area Fatschis near Trin municipality. In the evening, we arrived at our next accommodation in the old village Casti-Wergenstein, high in the mountains. After dinner we heard the presentation of Sebastian Nagelmüller about the Beverin Nature Park.

Achera-Biela protected area.

Feeding local fauna near Achera-Biela.

Left: lunch among the snow-capped mountains on the way to the Oberalp pass - right: Left: passing the Alps.

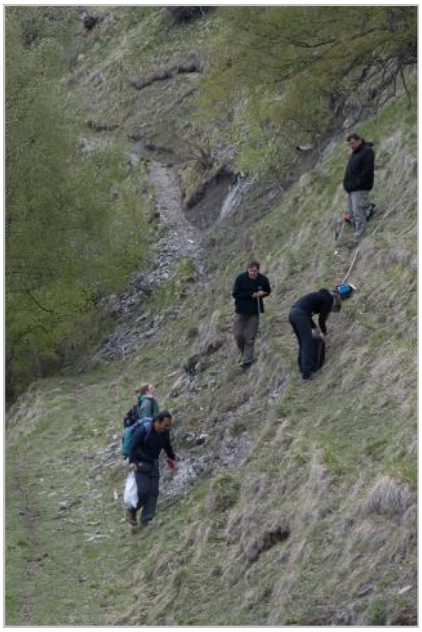
In the field with a merry mood.

Left: colourful semi-dry grassland in protected area Fatschis near Trin - right: in the village Casti-Wergenstein, we stayed in an old traditional house.

Day 7 (May 17, 2019)
During the first half of the day we sampled grazed semi-dry grasslands near our accommodation- as part of Beverin Nature Park. Afterwards we enjoyed the view of the snow and the early flowering *Pulsatilla verna* and *Crocus vernus* at Julierpass (2,284 m a.s.l.). After lunch, we sampled the dry grasslands near Zernez village. In the evening we stayed in the Berghaus Outdoor-Center Rezia-Martina in the lowest point of the Engadine, close to the Austrian border.


Beverin Nature Park.


Left: sampling in the Beverin Nature Park right: traditional architecture in the village of Casti-Wergenstein.



Left: Steep plot - right: Julierpass (2,284 m a.s.l.) – the highest point of the Alps that we climbed during the expedition.

Day 8 (May 18, 2019)
During this day we enjoyed sampling the vegetation in the Inn Valley. In the morning we worked near Sent. After having lunch in Ardez, a beautiful village with its characteristic painted houses, we sampled grasslands on the hill with the Medieaval Steinsberg castle. Later in the afternoon we visited another place near Susch.


Left: Sampling the steepest plot during the expedition - right: rocky grassland of the Inn valley.



Painted houses in Ardez village.

Sampling near the Steinsberg castle.

Our last accommodation in Martina village, during the plant identification in the evening.

Day 9 (May 19, 2019)

For the last day of our expedition we visited a site near Ramosch in the Inn Valley. Here we sampled meadow steppes of *Astragalo onobrychidis-Brometum* in the *locus classicus*, near the ruins of the Medieval castle. On the way back to Wädenswil, already in the Rhine catchment, we also sampled dry grasslands near Grüsch. It was a very nice, well-organized expedition which will remain in our memories.

Sampling near the Ramosch castle.

Animal paths on the slopes with dry grasslands in Grüsch.

Last lunch of the expedition and farewell words.

Selected pictures of plants

***Matthiola valesiaca, Alyssoides utriculata, Poa perconcinna, Orchis ustulata*.**

Thalictrum foetidum, Salvia pratensis, Clypeola jonthlaspi, Ephedra distachya subsp. helvetica.

Koeleria vallesiana*, *Orlaya grandiflora*, *Nonea pulla.

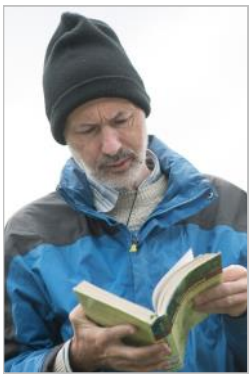
Participants of the 12th EDGG Field Workshop in Switzerland

Jürgen Dengler

Chiara Catalano

Susanne Riedel

Iwona Dembicz



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