DOI: 10.21570/EDGG.PG.63.27-35 *Research Article*

The GrassPlot dataset EU-R sampled during the 18th EDGG Field Workshop 2024 in the south-western inner-alpine valleys in France and Italy

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Palaearctic Grasslands 63 (2025): 27-35

Abstract: The 18th Field Workshop of the Eurasian Dry Grassland Group (EDGG) was conducted from 1 to 11 June 2024 in the inner-alpine valleys of the south-western Alps in France and Italy. The Field Workshop was a continuation of a series of Field Workshops in the inner-alpine valleys, using the standardised EDGG sampling methodology. The focus of the workshop was to survey the diversity of *Festuco-Brometea* and *Sedo-Sclerantethea* communities in the region including vascular plants, bryophytes, and lichens to fill data gaps for an up-to-date syntaxonomic classification of the inner-alpine dry grassland vegetation. The sampling campaign resulted in an extensive dataset, containing 241 10-m^2 plots with 86 of them nested in 43 EDGG Biodiversity plots (nested plots of 0.0001 to 100 (-1000) m^2). The dataset will be included in the GrassPlot database as dataset EU-R. The sampled plots were distributed across seven valleys in 36 municipalities and along an elevation gradient from 413 to 1860 m a.s.l. with a mean elevation of 1040 m a.s.l. As a first analysis, the mean vascular plant species richness at 10 m^2 was 33.3 without significant differences between the valleys and ranged between 9 to 63. These values resemble those reported from previous Field Workshops in the inner-alpine valleys but are consistently lower compared to other *Festuco-Brometea* communities outside the Alps. We propose that the dataset presented in this report will contribute to explaining this pattern and to update the syntaxonomic classification of the dry grasslands of the European Alps.

Keywords: Alps; biodiversity; dry grassland; *Festuco-Brometea*; France; GrassPlot, inner-alpine dry valley; Italy; *Sedo-Scleranthetea*; species richness, syntaxonomy; vegetation-plot database.

Nomenclature: Euro+Med (2025) for vascular plants; Mucina et al. (2016) for syntaxa.

Abbreviations: BP = Biodiversity plot; EDGG = Eurasian Dry Grassland Group; EU-DEM = European Digital Elevation Model; FR = France; IT = Italy.

Submitted: 5 January 2025; Accepted: 26 January 2025

Scientific Editor: Rocco Labadessa

Introduction

Since 2009, the Eurasian Dry Grassland Group (EDGG) has been organising annual Field Workshops to collect data and analyse plant diversity across the Palaearctic biogeographic realm with a special focus on under-represented regions and vegetation types (Dengler et al. 2016a). The aim of the workshops is to record biodiversity and vegetation composition following a standardised, multi-scale (0.0001-100 (-1000) m² nested plots) and multi-taxon (vascular plants, bryophytes, lichens, optional invertebrates) methodology, that has been developed within EDGG and improved over the years (Dengler et al. 2016b, Dengler et al. 2021). In 2017, GrassPlot, an EDGG-affiliated database, was launched to gather biodiversity data from the Field Workshops and other grassland surveys using one or multiple of the standard plot sizes applied in the EDGG methodology (Dengler et al. 2018; Biurrun et al. 2019). Since its establishment, the database has been used in numerous published studies and ongoing projects (Biurrun et al. 2021; Dembicz et al. 2021).

The annual EDGG Field Workshops continue to contribute to the database from regions and grassland habitats with scarce data coverage. Here we describe the dataset EU-R sampled during the 18th EDGG Field Workshop in June 2024 in the inner-alpine valleys of the south-western Alps and present some preliminary results. This Scientific Report thus should always be cited when the dataset EU-R is retrieved from GrassPlot and used in scientific papers.

In 2018, the EDGG started sampling biodiversity data of the dry grasslands in the inner valleys of the European Alps, following locations that J. Braun-Blanquet had visited for his seminal work on inner-alpine xerothermic vegetation (Braun-Blanquet 1961). Previous successful Field Workshops covered dry inner-alpine valleys in Austria (2018; Magnes et al. 2021), Switzerland (2019; Bergauer et al. 2022) and Italy/Switzerland (2023; Angelini et al. 2024).

While originally this Field Workshop was planned to be the last of the series dedicated to inner-alpine valleys, EDGG meanwhile has decided to cover additionally some valley systems of the European Alps that were not included in the seminal work of Braun-Blanquet (1961). The series already continued in late summer 2024, with the 19th Field Workshop in Ticino, southern Switzerland (Dengler et al. 2024), and the sampling will be continued in the form of a Master thesis in 2025. Moreover, in summer 2025, the 20th Field Workshop is planned in the Maritime and Ligurian Alps of Italy (Vynokurov et al. 2024b). When completed, the data from these six Field Workshops combined will allow a full-scale analysis of biodiversity patterns, syntaxonomy and vegetation changes in the inner-alpine valleys, based on standardised high-quality data.

Study area

The 18th Field Workshop took place from 1 to 11 June 2024 and focussed on the dry valleys of the south-western Alps in France and Italy (Figure 1). For more details, see Terracina et al. (2025), who provide a detailed summary of the Field Workshop including a plethora of photographs from the field activities. Low summer precipitation and warm air blown from the Mediterranean Sea create a climatic gradient in the study region of increasing Mediterranean influ-

ence from the inner to the outer parts of the valleys. Therefore, sub-Mediterranean and temperate subalpine vegetation is found in the valleys in proximity. In many places, succession of woody vegetation into previous semi-natural grasslands was visible as a result of large-scale abandonment of pastoral land-use practices, which is recognised as a large-scale threat to open habitats and their associated biodiversity in the Alps (Nota et al. 2021; Tasser et al. 2024).

To match the sampling of the three previous EDGG Field Workshops in the inner-alpine dry valleys, the aim of this expedition was to cover the full diversity of *Festuco-Brometea* (meso-xeric, xeric, and rocky grasslands) and *Sedo-Scleranthetea* (rocky outcrops) communities present in the region (Figure 2). While the classes *Festuco-Brometea* and *Sedo-Scleranthetea* were in the focus, we also collected a few plots of specific stands of other open habitats within the scope of GrassPlot (Dengler et al. 2018), namely a mesic grassland (class *Molinio-Arrhenatheretea*) and a halophytic community (class *Juncetea maritimi*).

The Field Workshop covered three valley systems and was co-organised by local expert groups from the three regions together with EDGG (Figure 1).

The first valley system was the Susa Valley, Italy, an 80 km long glacial valley stretching in a west-east direction from the French border towards the city of Torino. Sampling locations for three sampling days were selected by the organising team from the University of Torino in the lower, middle, and upper parts of the valley with some additional plots in the parallel Maurienne Valley, France. Climatic conditions, particularly daytime temperatures, in the southern and northern slopes of Susa Valley and Maurienne Valley vary substantially. Both valleys have a relatively dry climate and annual precipitation ranging between 600-900 mm. Due to these conditions, abundant and diverse (semi-natural) dry grasslands are present in the region.

The second valley system were the valleys of Durance and Queyras in France, stretching in a north-south direction. There, local experts from the French National Alpine Botanical Conservatory joined the research expedition and selected potential sampling plots. Durance is the southernmost

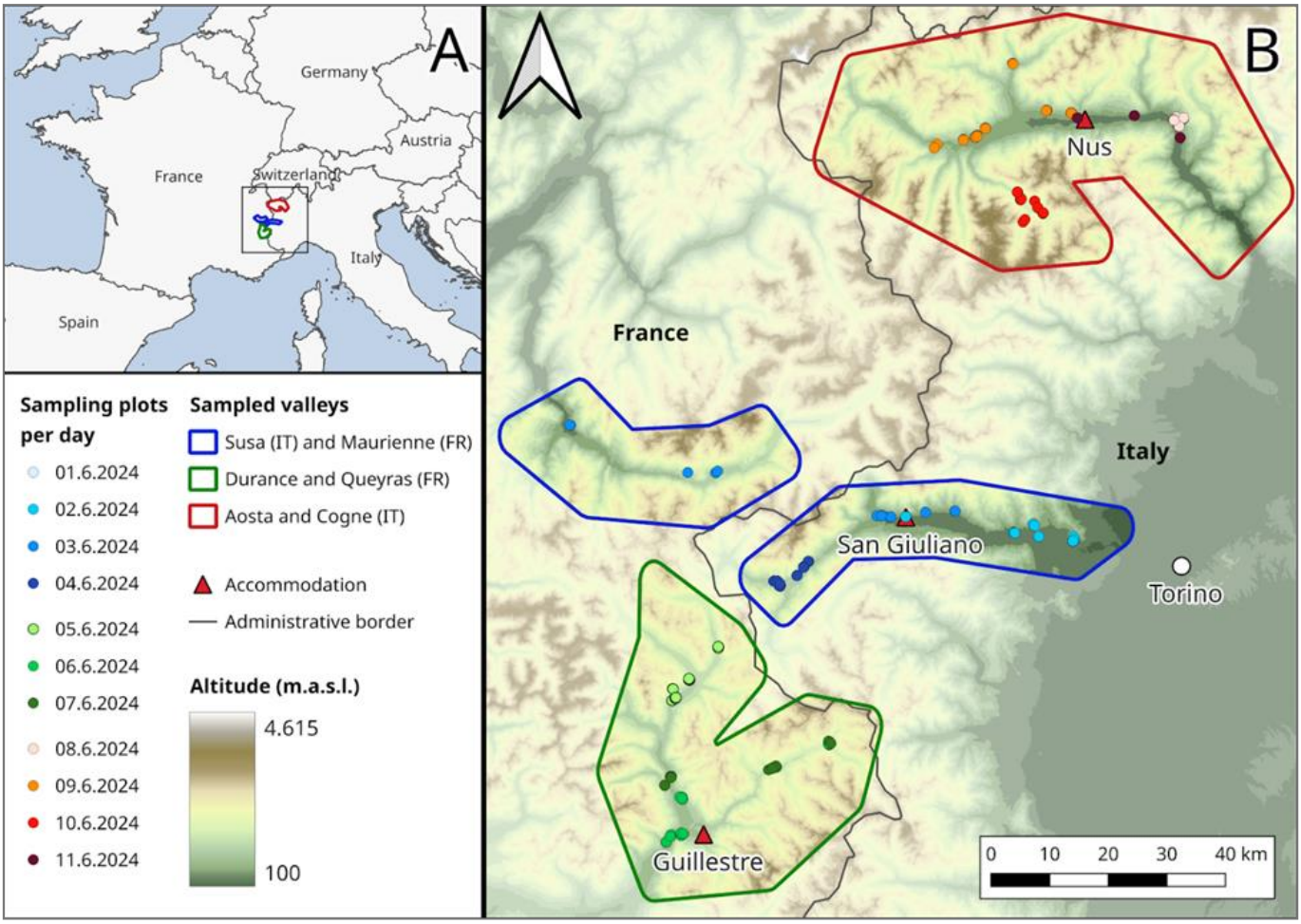

Figure 1. Location of the study areas (A) within Europe and (B) within the south-western Alps. The Field Workshop focused on three main valley systems (Susa, Durance/Queyras, Aosta/Cogne/Valpelline) with some supplementary sites in the Maurienne Valley. Each point represents one 10-m^2 plot. But note that they are often so close to each other that not all are visible. The background map is based on a digital elevation model (Data source: www.opentopodata.org).

inner-alpine dry valley, with annual precipitation ranging between 800-900 mm and strongly influenced by Mediterranean climate in the southern part, while Queyras is a tributary valley to Durance on higher elevation. Grasslands found in the region range from steppe-like *Stipa-communities* to meso-xeric *Brachypodietalia pinnati* communities.

Finally, the third valley system was the Aosta Valley, Italy, a west-east directed valley north of Torino. The climate in the Aosta Valley is drier than in the two other valley systems with annual precipitation ranging between 460 and 630 mm due to a barrier effect of the surrounding massifs of Gran Paradiso and Mont Blanc. Like the Susa Valley, southern and northern slopes in the Aosta Valley exhibit contrasting climatic conditions that support distinct communities ranging from Mediterranean to steppe-like grasslands. The tributary valleys of Cogne and Valpelline are at higher altitude than the main valley, but with a similar dry climate. In these three valleys, four more sampling days, supported by the Biodiversity Service and Scientific Research of the Gran Paradiso National Park, concluded the Field Workshop.

Overview of the sampling and state of the data

The 18th Field Workshop was the most productive since the establishment of these expeditions in 2009 in terms of plots sampled. In total, 241 plots of 10 m^2 plot size were sampled (Table 1). Of them, 86 plots were nested in 43 Biodiversity Plots, 41 with the largest plot of 100 m^2 and two with the largest plot of 1000 m^2. Every Biodiversity Plot included two 10 m^2 plots in two opposite corners, each with nested plots of 0.0001, 0.001, 0.01, 0.1, and 1 m^2.

The number of surveyed plots was evenly distributed between the three major valley systems. Most plots were located in the larger valleys of Susa, Durance and Aosta and fewer were surveyed in the valleys of Maurienne, Queyras, Cogne and Valpelline (Figure 1 and Table 1). The elevation of the sampling plots ranged from 413 to 1860 m a.s.l. (± 7 m, data extracted from Digital Elevation Model EU-DEM) with a mean elevation of 1040 m a.s.l. (Figure 3). Sampling locations in the valleys of Susa, Aosta and Maurienne were concentrated below 1000 m a.s.l., and above 1000 m a.s.l. in the valleys of Durance, Queyras, Cogne and Valpelline. The plots were distributed over 36 municipalities in France

Figure 2. Examples of the main vegetation types surveyed in the Field Workshop (with tentative syntaxonomic placements in brackets): top left: rocky outcrop communities (*Sedo-Scleranthetea*), top right: xeric rocky grasslands (*Festuco-Brometea*: *Stipo-Poion xerophilae* or *Diplachnion serotinae*), bottom left: xeric non-rocky grasslands (*Festuco-Brometea: Festucion valesiacae*), bottom right: meso-xeric grasslands (*Festuco-Brometea*: *Brachypodietalia pinnati*). Photos: J. Dengler.

and Italy, belonging to the provinces of Aosta and Torino in Italy and the departments of Hautes-Alpes and Savoie in France (Appendix 1). The municipalities with the highest number of 10-m² plots in Italy were Cogne (n = 30), Oulx (n = 27) and Saint-Vincent (n = 20). In France, the highest number of 10-m² plots were surveyed in the municipalities of Château-Ville-Vieille (n = 16), Saint-Martin-de-Queyrières (n = 15), Saint-Crépin (n = 15), and Saint-Clément-sur-Durance (n = 13).

Currently, the digitisation of the field data is ongoing, and the entries are being checked for accuracy and completeness. The identification of collected lichen (by Helmut Mayrhofer), bryophyte (by Iryna Rabyk), and vascular plant species (*Festuca spp*. [by Thomas Wilhalm] and *Thymus spp*. [by Fabrizio Bartolucci]) is ongoing. Moreover, the results of the analysis of the collected soils are awaited. Once everything is ready, the data will be included in GrassPlot as dataset EU-R.

Table 1. Summary of sampled plots in each valley and across all sites. In the Susa Valley, two of the Biodiversity Plots (BP) were additionally sampled up to 1000 m^2.

Valley (country)	10-m^2 plots (nested in BP)	Biodiversity Plots (BP)
Durance (FR)	64 (20)	10
Queyras (FR)	18 (8)	4
Susa (IT)	71 (30)	15 (2 x 1000 m^2)
Maurienne (FR)	7 (2)	1
Aosta (IT)	56 (16)	8
Cogne (IT)	22 (8)	4
Valpelline (IT)	3 (2)	1
SUM	**241 (86)**	**43**

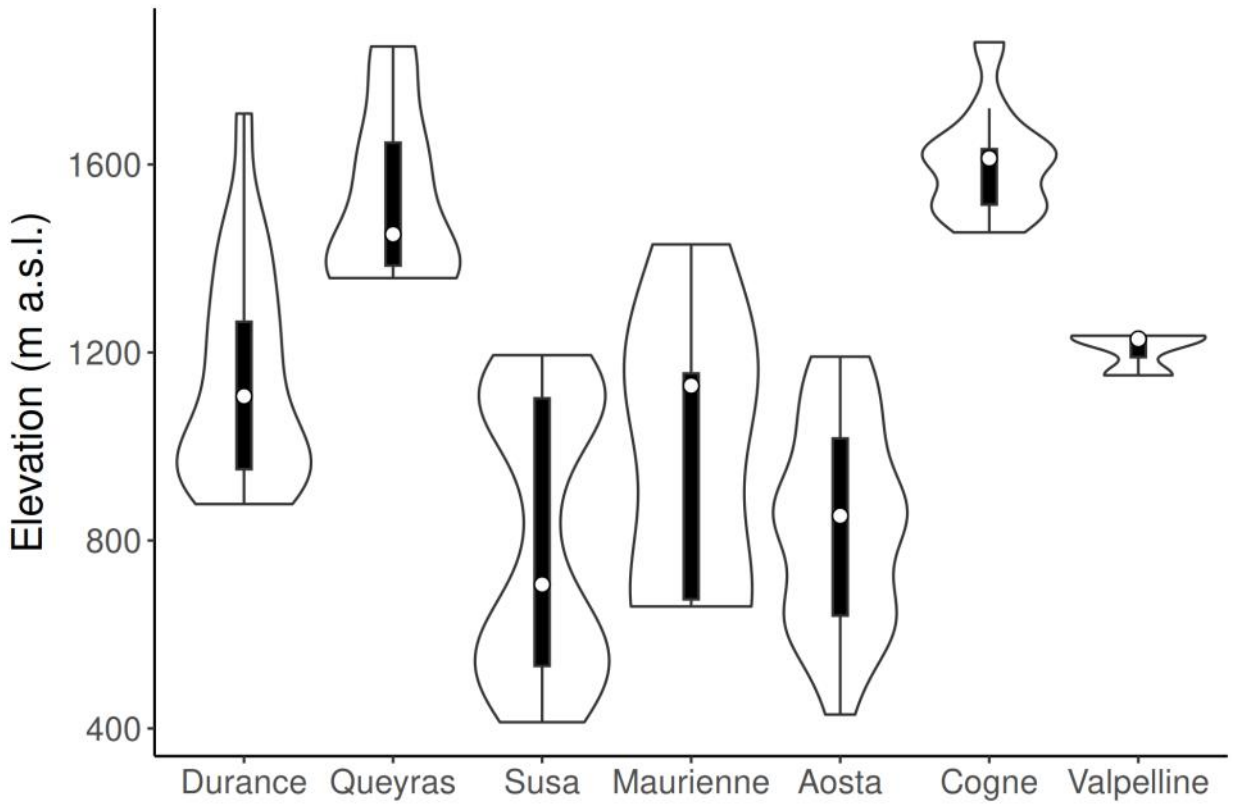

Figure 3. Elevation distribution of all sampling plots covered during the 18th Field Workshop with violin plots complemented by boxplots in the centre indicating the elevation distribution in each valley. Elevation data were extracted from GPS points and the digital elevation model EU-DEM with a precision of ± 7 m.

First results and their interpretation

While for comprehensive results we must wait for the completion of the dataset, it is already clear that three annual vascular plant species, not observed in the Aosta Valley for over a century, have been rediscovered during our expedition: *Bupleurum baldense, Hypochaeris glabra*, and *Trifolium dubium* (Guarino et al. 2024). Moreover, the annual grass *Brachypodium distachyon* was recorded for the first time in the Piedmont Region, specifically in the Susa Valley (Guarino et al. 2024).

Preliminary results from the species lists revealed that the mean species richness of vascular plants across all 10-m^2 plots across the *Festuco-Brometea* and *Sedo-Scleranthetea* communities was 33.3 ± 8.9 (mean ± SD). Variation of mean species richness between the sampled valleys was low and not significant (ranges from 30.6 ± 8.1 in Queyras to 34.9 ± 10.2 in Susa, ANOVA: F = 0.9, p = 0.49; Figure 4). The highest species richness was recorded in one plot in the municipality of Oulx in the Susa Valley with 63 vascular plant species in 10 m^2 (meso-xeric grassland) and the lowest in one plot in the municipality of Saint-Crépin in the Durance Valley with 9 species in 10 m^2 (rocky grassland). The plots in the halophytic community were excluded from this analysis and had on average 9.3 vascular plant species in 10 m^2 (n = 3). These values are in the range of vascular plant species richness values reported from previous Field Workshops of the inner-alpine valleys in Austria (mean: 34.2, range 16-71; Magnes et al. 2021) and Switzerland (mean: 29.3, range 7-55; Bergauer et al. 2022). Similarly, a previous sampling in the Cogne Valley using the EDGG methodology yielded 19–35 species in 10 m^2 (Wiesner et al. 2015). All these values are substantially lower than in *Festuco-Brometea* stands in other regions, such as Transylvania (mean: 49.7; Dengler et al. 2016a), Navarre (mean: 48.0; García-Mijangos et al. 2021), the Apennines (47.0; Cancellieri et al. 2024) or Armenia (46.8; Vynokurov et al. 2024a). This unexpected pattern previously highlighted and discussed by Bergauer et al. (2022), has been confirmed by the current dataset, thus calling for a good explanation.

Already during the Field Workshop, the syntaxonomic assignment of the studied communities gave rise to intensive discussions among the experts with broad-scale overview. In the absence of an updated numerical classification based on a representative dataset, the local experts still mostly adhere to the pre-computer typology of Braun-Blanquet (1961). However, it became clear that there is more diversity in the data than was captured in this seminal work, and

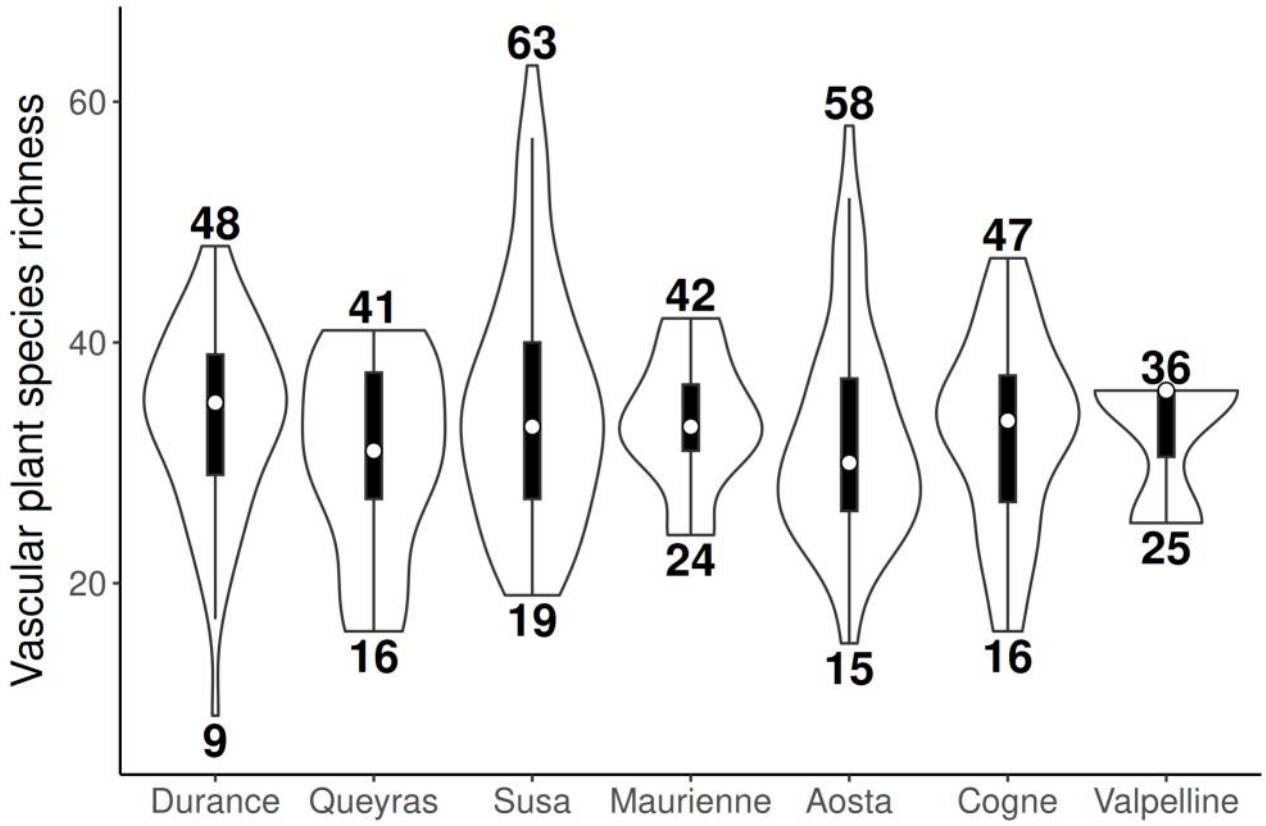

Figure 4. Vascular plant species richness in 10-m^2 plots compared across the seven valleys sampled during the Field Workshop. Violin plots complemented by boxplots in the centre indicate the distribution of species richness in each valley (values above and below the violin plot represent the maximum and minimum species richness, respectively). The mean species richness did not differ significantly between the valleys (ANOVA, p = 0.49).

syntaxonomy in Europe has developed much since then. Here we can only highlight a few issues that will have to be addressed in the planned comprehensive syntaxonomic analysis of all dry grasslands and rocky outcrop communities in the valleys of the European Alps (building on some first current attempts by Dengler et al. 2019; Magnes et al. 2021 and Willner et al. 2024). In the following, we use the syntaxon names accepted in Mucina et al. (2016), acknowledging that after the revision there might be substantial changes.

For the meso-xeric stands (*Brachypodietalia pinnati*, Dengler & Willner 2023), it needs to be clarified whether they should be assigned to the subatlantic *Bromion erecti*, to the subcontinental *Cirsio-Brachypodion pinnati* or to a new alliance to be described for the inner-alpine valleys. For the xeric stands, we found a differentiation into those on rocky sites and those on non-rocky sites, often with deeper soils and/or on ex-arable fields. This floristic differentiation is visible in the field, but it has not been reflected on higher syntaxonomic levels in the inner-alpine valleys so far, while in Europe at large, such stands are even placed in two different orders, *Stipo pulcherrimae-Festucetalia pallentis* and *Festucetalia valesiacae* (Willner et al. 2017). As in the Swiss canton of Valais, the non-rocky type in the SW Alps (often developed on former arable fields) corresponds closely to the alliance *Festucion valesiacae* (*Festucetalia valesiacae*) (Dengler et al. 2019), not usually recognized in syntaxonomic overviews of the region. The rocky types of the study region show a strong sub-Mediterranean influence, so their placement in the order *Stipo pulcherrimae-Festucetalia pallentis* is questionable (even more so in the order *Festucetalia valesiacae*). Among the rocky types, the stands at the outer, less continental parts of the valleys, showed resemblances to the alliance *Diplachnion serotinae*, while those in the inner parts corresponded rather to the *Stipo-Poion xerophilae*. These exciting questions will require solid broad-scale syntheses across the entire Alps and beyond, and we are confident that our high-quality dataset can substantially contribute to a convincing solution.

Conclusions and outlook

With 241 new 10-m^2 plots, this dataset contributes substantially to the datasets collected during the three preceding EDGG Field Workshops in inner-alpine valleys (Austria 2018: 67 – Magnes et al. 2021), Switzerland (2019: 142 – Dengler et al. 2020) and SE Alps (2023: 160 – Angelini et al. 2024). Together with the data from the conducted and planned Field Workshops in Ticino, Switzerland (Dengler et al. 2024), and in the Maritime Alps, Italy (Vynokurov et al. 2024b), respectively, these data will constitute a unique high-quality dataset of the dry grassland communities of almost the entire Alps, reaching geographically even beyond Braun-Blanquet (1961). This dataset will allow addressing the patterns and drivers of vascular plant, bryophyte and lichen diversity across spatial scales surpassing the scope of Bergauer et al. (2022) and thus will contribute to an understanding why the inner-alpine dry grasslands are poorer in species than dry grasslands elsewhere in Europe. Moreover, this international dataset will also enable to establish a data-driven classification scheme that is consistent across the Alps and fits into the European classification system (Mucina et al. 2016 and online updates). Finally, the data will also be a valuable contribution to the GrassPlot database (Dengler et al. 2018; Biurrun et al. 2019), facilitating analyses across the entire Palaearctic.

Author contributions

All authors contributed to field sampling and the compilation of the dataset. D.V. and J.D. are coordinating the EDGG Field Workshops and co-organised the 18th Field Workshop together with M.L., G.N., G.M., S.A. and A.M. The article was planned by D.V., J.D., C.K. and N.T. and drafted by C.K. and N.T. while J.D. contributed the preliminary thoughts on syntaxonomy. All authors edited and approved the manuscript.

Acknowledgements

We thank Sara Sánchez-Carmona and Simone Gea for contributing to the field sampling, Fabrizio Bartolucci, Helmut Mayrhofer and Thomas Wilhalm for their contributions in identifying critical taxa, and IAVS for funding travel grants to six participants of the Field Workshop. Further we thank the handling editor Rocco Labadessa and one reviewer for the fast and constructive feedback.

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Appendix 1. Distribution of the sampling plots among administrative units (municipality, province/department, country) and dates, separated for regular 10-m^2 plots (Normal plots) and nested-plot series ("Biodiversity Plots") and ordered according to sampling date.

Municipality	Country	Valley	Province (IT) / Department (FR)	Normal plots	Biodiversity Plots	Date
Susa	Italy	Susa	Torino	9	1	1./2./3.6.24
Condove	Italy	Susa	Torino	6	1	2.6.24
Almese	Italy	Susa	Torino	5	1	2.6.24
Villar Dora	Italy	Susa	Torino	4	1	2.6.24
Caselette	Italy	Susa	Torino	2	1	2.6.24
Caprie	Italy	Susa	Torino	2	1	2.6.24
Giaglione	Italy	Susa	Torino	10	1	3.6.24
Bruzolo	Italy	Susa	Torino	2	1	3.6.24
Bussoleno	Italy	Susa	Torino	2	1	3.6.24
La Tour-en-Maurienne	France	Maurienne	Savoie	3	1	3.6.24
Villarodin-Bourget	France	Maurienne	Savoie	3	0	3.6.24
Saint-André	France	Maurienne	Savoie	1	0	3.6.24
Oulx	Italy	Susa	Torino	19	4	4.6.24
Salbertrand	Italy	Susa	Torino	10	2	4.6.24
Saint-Martin-de-Queyrières	France	Durance	Hautes-Alpes	11	2	5.6.24
Puy-Saint-Pierre	France	Durance	Hautes-Alpes	6	1	5.6.24
Val-des-Prés	France	Durance	Hautes-Alpes	4	0	5.6.24
Puy-Saint-André	France	Durance	Hautes-Alpes	3	1	5.6.24
Saint-Clément-sur-Durance	France	Durance	Hautes-Alpes	11	1	6.6.24
Saint-Crépin	France	Durance	Hautes-Alpes	11	2	6.6.24
Risoul	France	Durance	Hautes-Alpes	5	0	6.6.24
Réotier	France	Durance	Hautes-Alpes	2	0	6.6.24
Abriès-Ristolas	France	Queyras	Hautes-Alpes	8	1	6./7.6.24
Château-Ville-Vieille	France	Queyras	Hautes-Alpes	10	3	7.6.24
La Roche-de-Rame	France	Durance	Hautes-Alpes	7	1	7.6.24
Champcella	France	Durance	Hautes-Alpes	4	2	7.6.24
Saint-Vincent	Italy	Aosta	Aosta	14	3	8.6.24
Montjovet	Italy	Aosta	Aosta	9	0	8./11.6.24
Saint-Pierre	Italy	Aosta	Aosta	11	2	9.6.24
Sarre	Italy	Aosta	Aosta	6	1	9.6.24
Doues	Italy	Valpelline	Aosta	2	1	9.6.24
Valpelline	Italy	Valpelline	Aosta	1	0	9.6.24
Arvier	Italy	Aosta	Aosta	2	0	9.6.24
Quart	Italy	Aosta	Aosta	12	2	9./11.6.24
Cogne	Italy	Cogne	Aosta	22	4	10.6.24
Saint-Denis	Italy	Aosta	Aosta	2	0	11.6.24