

Diversity of dry grasslands in Navarre (Spain)

Experiences from the 7th EDGG Field Workshop, 15-24 June 2014

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Abstract: *The 7th EDGG Field Workshop took place in Navarre, Spain, in June 2014. It was attended by 16 participants from 10 European countries. During the workshop, 35 nested-plot series ("biodiversity plots") and 49 additional normal plots, resulting in a total of 119 full relevés with vascular plants, bryophytes and lichens, were recorded. The surveyed areas included the Mediterranean, the Atlantic and the Alpine Regions. The most species-rich grasslands were recorded in the Sub-Mediterranean dry grasslands of the Calamintho-Seselietum montani in the Atlantic Region near the village Ithabar. During the workshop, 12 oral presentations on various topics in the field of grassland research were given by the participants. This article provides details of the organization and sampling methods used during the fieldwork as well as first results and an outlook. Comparisons with the previous EDGG expeditions and an illustrated diary are also included.*

Keywords: biodiversity; bryophyte; grassland; lichen; nested plot; vascular plant; vegetation classification; vegetation-plot database.

Introduction

The pioneer first research expedition of the EDGG was conducted in Transylvania (Dengler et al. 2009), it was followed by expeditions to Central Podolia, in Ukraine (Dengler et al. 2010), NW Bulgaria (Apostolova et al. 2011, Pedashenko et al. 2013), Sicily (Guarino et al. 2012), NW Greece (Dengler & Demina 2012) and Khakassia, in Russia (Janišová et al. 2013). The most recent expedition, the so-called 7th EDGG Field Workshop, was conducted for the first time in Western Europe. Our

destination was the Region of Navarre, in the northern part of the Iberian Peninsula, a small region with strong climatic gradients leading to high beta diversity. The new concept of Field Workshop includes, in addition to joint field sampling with advanced sampling methods of the previous Research Expeditions, oral presentations and related methodological discussions (Biurrun et al. 2013). These discussions were always an implicit part of previous EDGG expeditions, but the new title and new programme structure make this philosophy more explicit.

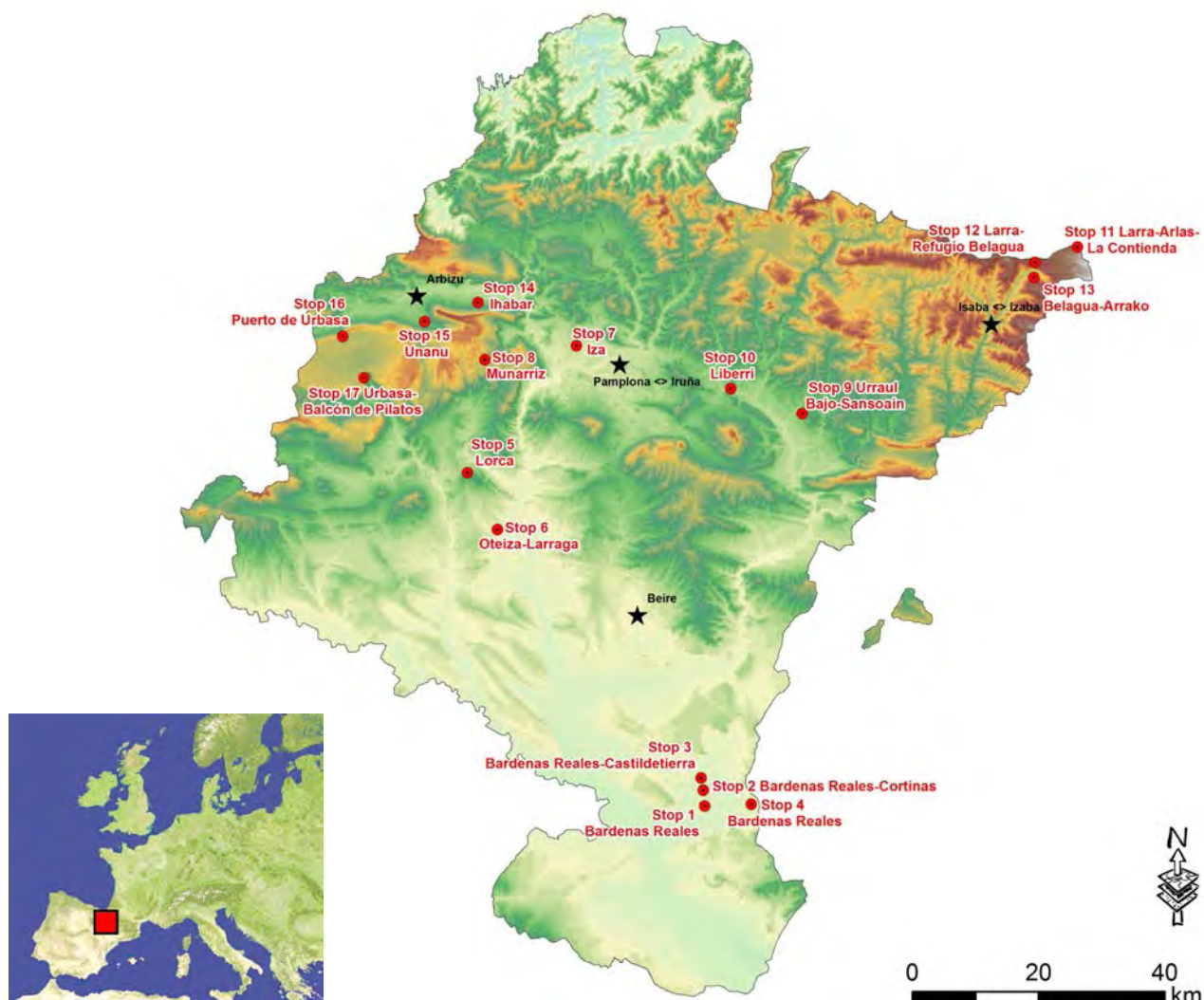


Fig. 1. Map of Navarre with location of the capital city, Pamplona, sampling sites and accommodation places.

In total, 16 scientists from 10 countries (Spain, Ukraine, Germany, Poland, Bulgaria, France, Italy, Norway, Slovakia and Turkey) participated in the eight days of fieldwork, 11 of them were partially supported by an IAVS grant. The group combined experienced senior scientist, young postdocs and PhD students. Jürgen Dengler, Monika Janišová, Hristo Pedashenko, Anna Kuzemko, Iwona Dembicz, Zygmunt Kački, Itziar García-Mijangos, Idoia Biurrun, Renaud Jaunatre and Goffredo Filibeck had already participated in previous expeditions, while Ute Jandt, Denys Vynokurov, Nina Polchaninova, Jörn Erik Björdalen, Asun Berastegi and Didem Ambarli were newcomers. As usually, standardised sampling methods were used to allow many different analyses, both at the regional scale (e.g. Dengler et al. 2012a, Turtureanu et al. 2014) and contributions to interesting large-scale comparisons and meta-analyses. The core part of the sampling are the so-called “biodiversity plots”, following ideas of Dengler (2009). Basically, they consist of nested sampled areas from 0.0001, 0.001, 0.01, 0.1, 1, 10 and 100 m², with the smaller ones always replicated twice within the big 100-m² plot. For each plot size, all vascular plants, bryophytes

and lichens that are superficially present (shoot presence or any-part system: Williamson 2003, Dengler 2008) are recorded. Additionally for the 10-m² plots, percentage cover per species and structural data of the vegetation are estimated and a set of environmental parameters related to topography and soil are determined. In each individual study region, the biodiversity plots are placed in homogeneous stands of different types with the aim to cover the full gradient of locally present grassland types. To complement this time-consuming sampling, we additionally survey “normal” plots, which have exactly the same parameters as the 10-m² corners of the biodiversity plots and can thus easily be combined with these for joint analyses.

This contribution starts with an introduction to the study area, followed by some preliminary results, conclusions and an outlook. After the reference section, an appendix with an illustrated diary follows.

Study area

The Spanish region of Navarre is located in central-northern Iberian Peninsula, 42° N and 1° W, in the border

with France, at the western end of the Pyrenees. The northern part almost reaches the Bay of Biscay (9 km from the nearest point), in the Atlantic Ocean. The region covers 10,391 km² with 644,477 inhabitants and a population density of 62 persons per km². Nevertheless, more than 50% of the population is concentrated in the metropolitan area of the capital city, Pamplona (Fig. 1). The Basque Mountains and the Pyrenees in the north and north-east have temperate climate, which becomes more continental towards the eastern part of the Pyrenees. In the southern part, the Ebro valley has a typical Mediterranean climate. Transitional areas in the central fringe show temperate sub-Mediterranean climate, with moderate summer drought. This latitudinal climatic gradient, which concerns especially to summer drought and continentality, is combined with the altitudinal gradient, very notable in the Basque Mountains and, in particular, in the Pyrenees, where the alpine or cryorotemperate belt is reached. As a result, mean annual temperature varies from less than 8 °C in the higher mountains to more than 14 °C in the Cantabrian valleys and Ebro depression, and mean annual precipitation from less than 400 mm in many parts of the Ebro depression to more than 2500 mm in some mountains facing the Atlantic Ocean. Due to this strong precipitation gradient, combined with the thermic changes, semiarid, dry, sub-humid, humid, hyper-humid and ultra-hyper-humid ombrotypes can be recognized (Peralta et al. 2014).

Although some Palaeozoic outcrops that have emerged during Hercynian orogeny (slates, quartzite, schist, limestone and granite) can be found in northern Navarre, most of the region is covered by younger, mainly Secondary and Tertiary sediments. The Pyrenees and the Basque Mountains are the main geological structures in the northern half, while the southern half belongs to the Ebro depression. Sandstone, clay, limestone and gypsum form the Tertiary sediments in the Ebro depression. The Basque Mountains are mainly constituted by Triassic sandstone (in the northernmost mountains) and limestone and marl from the Cretaceous and the Eocene (Loidi et al. 2011).

Regarding the potential vegetation, deciduous forests such as *Quercus robur* and *Fagus sylvatica* forests are dominant in the northern part, in the most humid areas of Atlantic (*Q. robur* and *F. sylvatica*) and Alpine (*F. sylvatica*) regions. The Ebro valley hosts potential sclerophyllous *Quercus rotundifolia* woodlands in dry areas and *Quercus coccifera* maquis in semiarid places. The central fringe with mostly temperate sub-Mediterranean climate corresponds to forests dominated by marcescent trees: *Quercus pubescens* and *Q. faginea* on limestone and marl (the former in the Atlantic and Alpine region, the latter in the Mediterranean region) and *Quercus pyrenaica* on sandstones. More detailed description of Navarran vegetation can be found in Biurrun et al. (2013) and Loidi & Bascónes (2006).

Our sampling was entirely conducted in the Ebro watershed, thus Cantabrian valleys with streams flowing into the Bay of Biscay were not visited, as they are mostly hyper-humid and dry grasslands occur here only on steep sandstone slopes (Darquistade et al. 2004). Therefore, the Atlantic influence has only been touched in the Basque Mountains (Urbasa and Andia ranges) and

surrounding valleys (Ihobar, Unanu, Iza), which belong to the Atlantic Region. The rest of sampling was made in the Alpine Region (Pyrenees) and the Mediterranean Region (Ebro depression).

Dry grasslands in Navarre

Semi-natural (secondary) dry grasslands were sampled, except of some azonal grassland on rocky places, especially in the subalpine belt (like in Larra). Regarding dry grasslands in the southern part (Bardenas-Reales), although theoretically they are secondary grasslands in areas originally dominated by sclerophyllous shrubs (*Quercus coccifera*), it is in fact quite difficult to imagine this succession, especially in the clayey areas. Almost all sampled grasslands are maintained by grazing, except for some mown grasslands in the Pyrenees and Urbasa that were apparently crop fields not so long time ago. Nevertheless, shrub encroachment is a growing process due to the changing land use. The sampled grasslands belong to the following phytosociological units, according to Berastegi (2013) and Rivas-Martínez et al. (2011):

***Festuco-Brometea*:** Dry grasslands and natural steppes of the sub-meridional to hemi-boreal zone occurring on deep, base-rich and loamy soils. In Navarre the most common ones belong to the association *Calamintho acini-Seselieta montani* (*Potentillo montanae-Brachypodium rupestris*), in the temperate sub-Mediterranean area, and *Carduncello mitissimi-Brachypodium phoenicoidis* and *Elytrigio campestris-Brachypodium phoenicoidis* (*Brachypodium phoenicoidis*), in more Mediterranean areas.



Plot ES28 *Calamintho-Seselieta*, Ihobar. Photo: I. García

***Festuco hystricis-Ononidetea striatae*:** Dry, basiphilous grasslands rich in hemicryptophytes and chamaephytes growing on cryoturbated soils in sub-Mediterranean areas of Southwest Europe. We have sampled Pyrenean subalpine dry grasslands growing in exposed rocky places: *Oxytropido pyrenaicae-Festucetum scopariae* and *Astragalo teresiani-Thymelaetum nivalis* (*Festucion scopariae*) and Basque-Cantabrian scrubby grasslands of the alliance *Genistion occidentalis*: *Helianthemo incani-Koelerietum vallesianae* (Urbasa mountain range), *Helictotricho cantabrici-Seslerietum hispanicae* (foothills of Urbasa) and *Thymelaeo ruizii-Aphyllanthetum monspeliensis* (sub-Mediterranean valleys). The alliance

Plantago discoloris-*Thymion mastigophori* was also sampled in wind exposed cryoturbated places in the southern face of Urbasa range (*Jurineo humilis*-*Festucetum hystricis*).



Jurineo humilis-*Festucetum hystricis*. Balcón de Pilatos.
Photo: J. A. Campos

Lygeo-Stipetea: Mediterranean pseudo-steppes and related perennial xerophilic grasslands. We sampled both tall grasslands dominated by *Lygeum spartum* growing on deep clayey flat soils (*Stipo parviflorae*-*Lygeetum sparti*, *Agropyro pectinatae*-*Lygeion sparti*) and short grasslands dominated by *Brachypodium retusum* growing on calcareous soils often with a stony or gravel upper layer (*Ruto angustifoliae*-*Brachypodietum retusi*, *Thero-Brachypodium retusi*).



Stipo-Lygeetum sparti, Bardenas Reales. Photo: D. Ambarli

Kobresio myosuroidis-Seslerietea caeruleae: Subalpine and alpine calcareous grasslands growing on moderated or long snow cover soils in Alpine region. In northern Iberian Peninsula it extends to Cantabrian Mountains, often in the upper supratemperate (altimontane) belt. For example, in the Basque Mountains of Navarre we sampled grasslands of the association *Aquilegio pyrenaicae*-*Seslerietum caeruleae* (*Salicion pyrenaicae*), but most of grasslands of this unit occur in the Pyrenees, where we sampled grasslands of *Dryado-Salicetum pyrenaicae* (*Salicion pyrenaicae*) and *Primulo intricatae*-*Horminietum pyrenaici* (*Primulion intricatae*).

Tuberarietea guttatae: Mediterranean low-grown swards dominated by annual grasses and herbs. These therophyte communities grow in the open areas of dry perennial



Plot ES18, *Primulo-Horminietum*, Larra. Photo: M. Janišová

grasslands and scrubs, and consequently they have been sampled especially in the smallest sampling scales. Basiphilous annual grasslands of the alliance *Brachypodium distachyi* were sampled: *Saxifraga tridactylitae*-*Hornungietum petraeae* in the Ebro depression, *Minuartio hybridae*-*Saxifragetum tridactylitae* in submediterranean areas and *Bupleuro baldensis*-*Arenarietum ciliaris* in cryoturbated places of the southern face of Urbasa mountain.

Rosmarinetea: Secondary dwarf scrub species-rich communities growing on eroded stony soils in Western Mediterranean. In the Ebro depression we have sampled open scrubs of *Salvia lavandulifoliae*-*Ononidetum fruticosae* (Oteiza-Larraga) and *Rosmarino officinalis*-*Linietum suffruticosi* (Bardenas).

Nardetea strictae: Secondary intensive grasslands and high mountain natural grasslands growing in summer moist deep and acid soils in Alpine and Atlantic Regions. In Navarre they occur both in the Pyrenees (*Nardion strictae*) and the Basque Mountains (*Violion caninae*), but we have only sampled those from Pyrenees.

Molinio-Arrhenatheretea: Include mesic to wet often manured meadows and pastures maintained by grazing and mowing but with Eurasiatic origin. We sampled montane mown grasslands of the association *Rhinantho mediterranei*-*Trisetetum flavescens* (*Arrhenatherion*) in the Pyrenean valley of Belagua and in Urbasa foothills.

Sedo-Scleranthetea: Perennial succulent *Crassulaceae* communities rich in therophytes growing on rocky places. In Navarra, both silicolous and basiphilous communities occur, but we have only sampled basiphilous ones with *Sedum album*, *S. acre* and *S. amplexicaule*.



Arrhenatherion in Belagua. In the slopes, plot ES25, *Calamintho-Seselietum*, *Cynosurion*. Photo: M. Janišová

***Sarcocornietea fruticosae*:** coastal and inland Mediterranean and Cantabrian-Atlantic salt-marshes and salt-pan communities. We have sampled temporary wet high saline *Limonium*-rich tall grasses formed by *Lygeum spartum* from the semiarid Ebro depression (*Limonion catalaunico-viciosoi*): *Limonio viciousi-Lygeetum sparti*.

Nature conservation

Most of the surveyed grasslands are considered habitats of European importance and, in addition, they host rare plants included in several catalogues and Red Lists of endangered flora (Peralta et al. 2014), such as *Limonium ruizii* and *Senecio auricula* in halophilous grasslands of the association *Limonio viciousi-Lygeetum sparti*, of priority interest (1510*), *Astragalus clusianus*, *Sideritis spinulosa* and *Thymus loscosii* in mediterranean scrubs of *Rosmarinetaea* (4090), *Narcissus asturiensis* subsp. *jacetanus* and *Orchis papilionacea* in submediterranean scrubs of *Thymelaeo ruizii-Aphyllanthesetum monspeliensis* (4090), *Ziziphora hispanica* subsp. *aragonensis* in annual basiphilous grasslands of *Brachypodium distachyi* (6220*), *Astragalus clusianus*, *Medicago secundiflora*, *Narcissus asturiensis* subsp. *jacetanus*, *Narcissus triandrus* subsp. *pallidulus*, *Orchis papilionacea* and *Ziziphora hispanica* subsp. *aragonensis* in mediterranean dry grasslands of *Ruto-Brachypodietum retusi* (6220*), *Dactylorhiza insularis* and *Narcissus asturiensis* subsp. *brevicoronatus* and subsp. *jacetanus* in temperate submediterranean dry grasslands of *Calamintho-Seselietum montani* (6210*), *Helianthemum incanum-Koelerietum vallesianae* (6210) and *Helictotricho cantabrigi-Seslerietum hispanicae* (6210), *Narcissus pallidiflorus* and *Narcissus poeticus* in mown grasslands of *Arrhenatherion* (6510), *Narcissus pallidiflorus* and *Nigritella gabasiana* in Pyrenean subalpine *Nardus* grasslands (6230*), *Arenaria vitoriana*, *Armeria cantabrica* subsp. *vasconica*, *Centaurea lagascana*, *Erodium daucoides*, *Lomelosia graminifolia* and *Narcissus asturiensis*

subsp. *jacetanus* and subsp. *brevicoronatus* in wind-exposed grasslands of *Jurineo humilis-Festucetum hystrix* (6170), *Festuca altopyrenaica*, *Lathyrus bauhini* and *Minuartia cerastiifolia* in subalpine dry grasslands of *Festucion scopariae* (6170), *Adonis pyrenaica*, *Arctostaphylos alpinus*, *Buglossoides gastonii*, *Lathyrus vivanii*, *Leucanthemum maximum*, *Nigritella gabasiana* and *Pulsatilla alpina* subsp. *fontqueri* in subalpine grasslands of *Kobresio-Seslerietea* (6170).

Plant determination during the expedition

We were very lucky because Asun Berastegi, who recently finished her PhD on grassland vegetation in Navarre, was participating in the Field Workshop and helped a lot with plant identification. Every participant had a copy of her PhD dissertation with the floristic catalogue and relevé tables (Berastegi 2013). We used Claves ilustradas de la Flora del País Vasco y territorios limítrofes (Aizpuru et al. 1999) as reference flora, which was complemented by the Exkursionflora (Jäger & Werner 2007) and the Flora Vegetativa (Eggenberg & Möhl 2007), both very useful for non-flowering specimens.

First results

We surveyed 35 biodiversity plots and 49 additional normal plots, resulting in a total of 119 full relevés, 117 of them with soil samples. These results were obtained during effective eight day sampling, from 16 to 23 June. The same period was also partially devoted to oral presentations and transfer among sampling sites. Table 1 shows the results of the FW in Navarre in comparison with the previous expeditions.

Twelve biodiversity plots and 17 additional normal plots were sampled in the Mediterranean Region (Bardenas Reales, Lorca, Oteiza-Larraga, Sansoain, Iliberri), 13 + 18 in the Atlantic Region (Iza, Munarriz, Ithabar, Unanu, Urbasa) and 10 + 14 in the Alpine Region (Larra, Belagua). Overall, this is a good number of replicates and a relatively balanced design, which should allow for powerful statistical analyses. In addition to the vegetation, during this 7th Field Workshop also one group of invertebrates (spiders) were sampled on the same plots by Nina Polchaninova.

While we are still busy with determining some remaining plant samples and digitising the data, it is already clear where the regional phytodiversity hotspot at small grain sizes is located: The Sub-Mediterranean (semi-)dry grasslands (association *Calamintho-Seselietum montani*)

Table 1. Data on the seven EDGQ Expeditions and Field Workshops

No.	Period	Research area	Altitude (m a.s.l.)	Participants	Countries	Nested-plot series	10-m ² plots
1	14-26 July 2009	Transylvania (Romania)	321-670	6	3	20	63
2	10-25 July 2010	Central Podolia (Ukraine)	73-251	18	8	21	226
3	14-24 August 2011	NW Bulgarian mountains	633-1460	9	5	15	98
4	29 March - 5 April 2012	Sicily (Italy)	4-1200	14	5	21	67
5	15-23 May 2012	N Greece	1-1465	16	6	14	31
6	22 July - 1 August 2013	Khakassia (Russia)	300-700	14	7	39	133
7	15-24 June 2014	Navarre (Spain)	295-1970	16	10	35	119

in the Atlantic Region (Ihobar) were the richest of the expedition at various scales. Here we found up to 44 (36) species on 0.1 m², 65 (52) on 1 m², 95 (74) on 10 m² and 129 (103) on 100 m². These data include vascular plants, bryophytes and lichens, while values in brackets are for vascular plants only, and they might slightly change when the determination of samples is finished. Vascular plant richness at the 0.1- and 10-m² scale is thus only about 20% below the known global maxima (Wilson et al. 2012). When considering total phytodiversity, among the EDGG Expeditions, only the one in Transylvania found higher maxima (e.g. 101 species on 10 m²: Dengler et al. 2012a), while the highest 10-m² values in Ukraine (67 species: Kuzemko et al. 2014), Bulgaria (62 species: Pedashenko et al. 2013), Sicily (70 species: I. Dembicz et al. unpubl.) and Khakassia (75 species: Janišová et al. 2013) were clearly below those in Ihobar.



The evening work in Isaba. Photo: J. Dengler

Oral presentations

There were four keynote-lectures by the organizers of the Field Workshop: Jürgen Dengler gave us his lecture on the EDGG expedition methodology in the field, before starting our first biodiversity plot. Idoia Biurrun, Asun Berastegi and Itziar García-Mijangos introduced the participants into the general features of the study area: climatic gradients and main vegetation patterns (Idoia), grassland typology (Asun) and order *Brachypodietalia phoenicoidis* (Itziar). These three keynotes about Navarre were given at the beginning of the Field Workshop, in our first accommodation in Beire.

Other participants in the Field Workshop also contributed with presentations about results of similar studies and concepts/methods of emerging studies at early stages:

Anna Kuzemko: *Grassland vegetation of Forest and Forest-Steppe zones of Ukraine*

Zygmunt Kącki: *Statistical determination of diagnostic, constant and dominant species of the higher vegetation units of Poland using the Cocktail method*

Monika Janišová: *Grassland diversity in the Ukrainian Carpathians – aims, methods and preliminary results*

Denys Vynokurov: *Syntaxonomical differentiation of the Festuco-Brometea class in the Steppe zone of Ukraine*

Didem Ambarli: *Steppe Communities of Central Anatolia under various land use*

Nina Y. Polchaninova: *Some methods of collecting invertebrates in biodiversity research. A case study of animal and plant communities under grazing pressure in steppe sites of eastern Ukraine*

Hristo Pedashenko: *Dry grasslands of NW Bulgarian mountains*

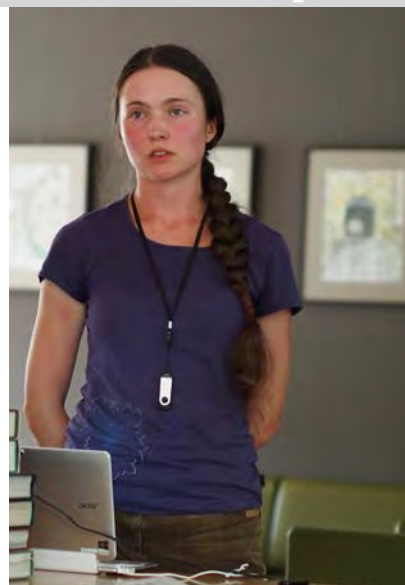
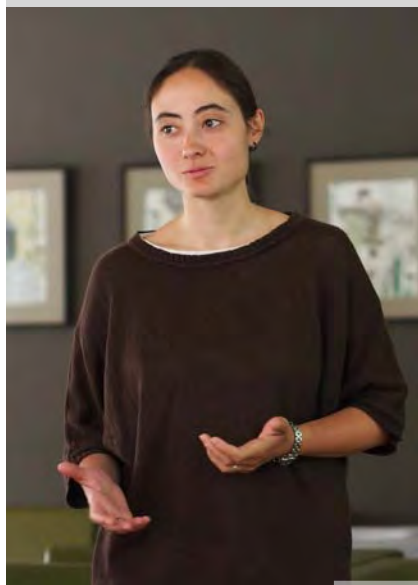
Iwona Dembicz: *Chosen functional traits as indicators of vascular plant diversity response to habitat isolation in the Pontic steppe zone (southern Ukraine)*

In total, there were 12 presentations followed by intensive discussions. Every participant supported by the IAVS grant made an oral presentation.

Conclusions and outlook

Our plan is to have the data ready for analysis in the next few months. Still there is some work to do with vascular plants, as many small pieces were collected for further determination. Bryophytes and lichens have been sent for determination to specialists, and soils samples are going to be analyzed by a Turkish colleague. Data entry is on progress, and a preliminary paper on classification and richness patterns of dry grasslands in Navarre has already been designed and the abstract sent for evaluation to the editorial board of a special issue of *Phytocoenologia*. In this paper we will try to clarify the classification of sub-Mediterranean grasslands, as some associations described to gather them, such as *Thymelaeo-Aphyllanthetum*, are rather heterogeneous and are included in different classes (*Rosmarinetea* and *Festuco-Ononidetea*) by different authors (Berastegi 2013, Berastegi et al. 2005, Peralta & Olano 2001). Afterwards, it will be interesting to compare the biodiversity patterns and species-area relationships with those of the previous EDGG expeditions and similar datasets. We will also use the 10 m² data together with data from other geographical areas to contribute for a consistent classification of European grasslands (Dengler et al. 2013). In particular, we will try to clarify some syntaxonomical issues, such as the arrangement of the class *Festuco-Brometea* at order and alliance level and the delimitation of the class *Festuco hystricis-Ononidetea striatae* and some of the grasslands it contains. Last but not least, we assume that our dataset of scale- and taxon-dependent richness patterns in grasslands will contribute to solving two major ecological riddles that are closely related: Why are many grasslands very rich at small spatial scales, but few of them exceptionally so (Dengler et al. 2014a)? How can so many species co-exist in one plot (Wilson et al. 2012)?

As for previous EDGG Research Expeditions, the sampled data will become part of the Database Species-Area Relationships in Palaearctic Grasslands (Dengler et al. 2012b; GIVD ID EU-00-003) and additionally of the Vegetation-Plot Database of the University of the Basque Country BIOVEG (GIVD ID EU-00-011), both registered in the Global Index of Vegetation-Plot Databases (GIVD; <http://www.givd.info>; see Dengler et al. 2011). After our initial publications, they will become freely available for use by other researchers. Moreover, through BIOVEG, they will also become part of the European Vegetation Archive (EVA: Chytrý et al. 2014) and of the global plot database sPlot (Dengler et al. 2014b).



Didem Ambarli, Denys Vynokurov, Iwona Dembicz, Hristo Pedashenko and Nina Polchaninova (pictures above) giving lectures to the audience (picture below). Photos: M. Janišová and J. Dengler



After seven successful expeditions, the EDGG will continue its field research programme. Next year the 8th EDGG Field Workshop will take place in Poland, as it is announced in this issue of bulletin. For the years 2016-2019 we have already four offers to host the field workshop: Southern France/French Alps, Central Apennine, Anatolia and Kazakhstan. Persons interested in organising future EDGG Expeditions are encouraged to contact the EDGG Expeditions Coordinator (Jürgen Dengler).

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Plant determination in Bardenas Reales. Photo: J. Dengler



Sampling in Belagua, Pyrenees. Photo: J. Dengler

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The famous Ukrainian singers, Anna and Denys with their manager Zygmunt, made our journey very pleasant. Photo: M. Janišová



15 June 2014

After arrival of the expedition participants to Bilbao airport we travelled by two small buses driven by Itziar and Idoia to our first accommodation place in the Ebro valley, the village of Beire. Itziar was the first to arrive at Beire with the earliest people (Iwona, Didem, Ute, Monika, Goffredo and Denys), and on her way to Beire she picked Asun up in her town, Arbizu, our last accommodation place at the end of the field workshop. When the first group had already had dinner in our Hotel Beitu, the bus driven by Idoia, who picked up the latest participants, arrived with Jörn, Jürgen, Anna, Zygmund and Hristo. Still there were two people missing, Renaud and Nina, that arrived very late at the airport but managed to join us the next day.



16 June 2014

After a more or less relaxing sleep only disturbed by the church's bells, that were playing every hour (!), we took our buses and travelled southwards to Bardenas Reales natural park. This really amazing place is a big unpopulated area grazed by big sheep herds during the autumn, winter and early spring; there are also wheat crops. The climate is very dry, mainly semi-arid, hot in summer and quite cold in winter, and clayey hills with sandstone cover outstand in the landscape. In humid places Tamarix bushes and salt pans are common. In this special place we sampled our first biodiversity plot, altogether, after Jürgen introduced us in the sampling methodology.

The first plots take always longer, and by the time we started the second one it was midday and Asun and Idoia went to the nearby city of Tudela to pick Nina and Renaud up, which had managed to travel by bus from Bilbao with a stop in Pamplona. So by lunch time, normally quite late in the Spanish timetable, all participants were together and ready to go back to the sampling in Bardenas Reales, that continued until light went down in the evening. We sampled, in an altitudinal range of 295-340 m a.s.l., four biodiversity and four normal plots in Mediterranean perennial grasslands of *Brachypodium retusum* and *Lygeum spartum*, as well as annual grasslands of *Brachypodium distachyi* developing in the clearings of the perennial grasslands and *Rosmarinus* scrubs. Back in Beire we had a delicious dinner and went to our working place to work with the samples.





This is the richest 0.1 m² plot with 44 species





17 June 2014

The second expedition day was also dedicated to Mediterranean dry grasslands, but more to the north, and so in not so dry places. We travelled northeast towards the historical town of Estella. On the way, we visited Santa Maria de Eunate, a Romanic church from the year 1170 in the St. Jaques way. There we took our first group picture. Eunate means "a hundred doors" in Basque language, and that has probably something to do with the structure with many arcs that surrounds the church.

After this short break we continued until our first stop near the village of Lorca, in the limit between dry and sub-humid ombrotypes, with *Quercus rotundifolia* and *Q. faginea* forests as potential vegetation. There we made eight biodiversity and eight normal plots in grasslands dominated by *Brachypodium retusum* and *Brachypodium phoenicoides*, at different altitudes (510-35 m a.s.l.) and soil depths. We spent almost all day in Lorca, but on our way back to Beire we had still time for another stop in some marly hills between the villages of Oteiza and Larraga, in a landscape dominated by wheat crops under dry ombrotype, potentially covered by *Quercus rotundifolia* woodlands. There we made three normal plots in dry grasslands of Ruto-*Brachypodietum retusi*. We arrived late in the evening at Beire, but we had still time to have our first oral presentation after dinner, with Idoia introducing the general features of Navarre regarding climate and vegetation.



18 June 2014

During our third sampling day we went further to the north, to sub-Mediterranean valleys in the transition between Atlantic and Mediterranean regions. But before leaving Itziar and Asun gave their keynote-lectures about grasslands in Navarre during the breakfast. Our first stop was in Iza (427-450 m a.s.l.), a village near Pamplona with temperate sub-Mediterranean climate where we sampled one biodiversity and six normal plots with dry grasslands of the alliance *Brachypodium phoenicoidis*. After finishing we moved to the village of Munarriz in the southern slopes of Andia mountain range, once again in the limit of two regions, but still in the Atlantic one, with potential vegetation of *Quercus pubescens*, and *Fagus sylvatica* on the top. There we had lunch and surveyed three biodiversity plots and three normal plots in grasslands of *Calamintho-Seselietum montanae* (950-980 m a.s.l.), and, on the top of a cliff (1030 m a.s.l.), communities with *Sedum album* and *S. amplexicaule*. On our way back to Beire, the bus driven by Idoia was full of beautiful Ukrainian songs: Anna and Denys started to sing and they would not stop until the field workshop finished! It was really fantastic. That was our last night in Beire so after dinner, once again late, we picked up the working room so that the next day we could leave quickly.

19 June 2014

The day did not start very well, as when we were ready to put all stuff in the buses and leave Beire someone realized that one of the buses had a flat tire. But every problem brings an opportunity and while Idoia and Itziar went to the nearby town of Olite to get the tire repaired, the rest of the group was listening to the oral presentations of Anna, Monika and Zygmunt. After leaving Beire we drove north towards the Pyrenees. We stopped in two places, once again in the limit between the Atlantic and the Mediterranean regions, but more continental than those of the previous day. First we sampled near the village of Sansoain, in a hilly place at 560-580 m a.s.l. very encroached with *Buxus sempervirens*. Two biodiversity and two normal plots of *Thymelaeo-Aphyllanthetum* and *Carduncello-Brachypodietum* were sampled. This was the hottest day during the field workshop, and for lunch we looked for shelter in the old monastery of Santa Fe. After lunch we continued sampling near the village of Liberrí, more to the west, at 500-520 m a.s.l., where we also sampled grasslands of *Thymelaeo-Aphyllanthetum* and *Carduncello-Brachypodietum*. It was a long and productive day, if we take into account that in addition to four biodiversity and four normal plots we had oral presentations, flat tire, and travel from the Ebro valley to Pyrenean valleys. And still we had time to stop and visit Foz de Arbayun, an impressive gorge that the Pyrenean Salazar river has formed on its way southwards to Ebro valley.





20 June 2014

This night and next two ones we slept in Isaba hotel, in the village of Isaba, the highest one in the Pyrenean Roncal valley. We spent the whole day in the subalpine belt, in Larra massif, where we sampled five biodiversity and eight normal plots in grasslands of *Festucion scopariae*, *Primulion intricatae*, *Salicion pyrenaicae* and *Nardion strictae*, in an altitudinal range of 1725-1970 m a.s.l.. All these grasslands form a mosaic of azonal and successional communities according to slope, orientation, snow cover and soil depth. Potential vegetation in the area is a *Pinus uncinata*-woodland.



21 June 2014

The sixth sampling day we also worked in the Pyrenees, but we stayed in the montane belt, in the valley of Belagua, where we stopped in two places, with an altitudinal range of 935-1560 m a.s.l., both potential beech forests. In the morning we surveyed three biodiversity and three normal plots of Nardion, Sedo-Scleranthetalia and Potentillo-Brachypodion rupestris grasslands near the mountain refuge of Belagua, on the southern slopes of Lakora mountain. After having lunch surrounded by Pyrenean cattle, we went down to the valley, where we sampled two biodiversity and three normal plots in Calamintho-Seselietum (Potentillo-Brachypodion), Rhinantho-Trisetetum flavescens (Arrhenatherion) and some kind of mixture of Calamintho-Seselietum, Cynosurion and violon caninae in slopes. On this day, we finished our sampling earlier than the others and so back in Isaba we were able to have our last presentation session. Didem, Denys, Hristo, Iwona and Nina showed us the results of their research and presented us new projects. There was an interesting discussion after each presentation.

22 June 2014

This journey we travelled from the Pyrenean Region to the Atlantic Region, thus, from our accommodation place in Isaba to Arbizu, the village of our guide, Asun. We made two stops in Sakana valley (570-610 m a.s.l.), drained by Arakil river, tributary of Ebro river. Thus, although we were in the Atlantic region we were in the Mediterranean watershed, with some influence of Mediterranean climate. In fact, temperate sub-Mediterranean climate is very common in these areas of the Atlantic region belonging to Ebro basin. First stop was near the village of Ithabar, where we sampled grasslands of Calamintho acini-Seselietum montani dominated by the hybrid between Brachypodium rupestre and B. phoenicoides. These were very rich grasslands and sampling took quite a long time, therefore we only managed three biodiversity and two normal plots, but what plots! After a quite late lunch, we moved to our second sampling site, near the village of Unanu. There we could do two biodiversity and one normal plot before it started raining. Fortunately we were very close to our accommodation place in Arbizu, where we slept in a camping site under the impressive Beriain mountain.







23 June 2014

During our last sampling journey we also stayed in the Atlantic region, but we climbed from the valley up to Urbasa mountain. Our first stop was still in the valley, at the bottom of Urbasa mountain pass, at 600-615 m a.s.l., where our colleagues from the University of the Basque Country Javier Loidi, Mercedes Herrera and Juan Antonio Campos joined us to participate and help in the last plots. In this first stop we sampled five normal plots in grasslands of *Helictotricho-Seslerietum hispanicae* and *Arrhenatherion*. Afterwards we went up to the top of the mountain (900-950 m a.s.l.), where we stayed the rest of the journey. This is a big area with beech forests and a mosaic of grasslands of *Calamintho-Seslerietum*, *Helianthemo-Koelerietum* and *Jasione-Danthonietum* (Violon) grazed by cattle, sheep and horses. We first did four biodiversity and one normal plot just on the top of the mountain pass, in the mentioned grasslands and also in grasslands of *Primulion intricatae* in north facing steep slopes. Finally, we moved southwards to reach the place called Balcón de Pilatos, an impressive cliff on the southern extreme of Urbasa range, with a dramatic depth of 900 m a.s.l. over the Amescoas valley, already in the Mediterranean region. There we did our last sampling, two normal plots in the association *Jurineo humilis-Festucetum hystrioides*. The field workshop ended quite dramatically, as storm was coming fast while we were working in the last plots. When we were writing the last plant coverages, the first drops started to fall and next seconds we were running to the buses because the sky was falling over our heads. Fortunately, we had our last group picture before sampling, and now we can show that image.

The way back to the valley across Urbasa mountain was a nice experience: storm was very strong, all was dark and thunders and rays did not stop. Our colleagues from Bilbao left us and took Zygmunt with them. During the day Jörn and Asun had also left, so we only rested 13 people. When we arrived to the camping site it was really difficult to move from our bungalows to the working place and the restaurant, because all the paths were flooded and muddy. We could manage and after dinner we organized samples (soils and plants) and had a short meeting to talk about the organization of plant determination, data entry and soil analysis and future field workshop venues.





24 June 2014

We got up early and travelled directly to Bilbao airport because some participants had to be at the airport quite early. Before leaving Navarre we left the Ukrainian group, Anna, Nina and Denys on the bus to Pamplona. They continued the travel through Navarre, but the rest of people said goodbye to this beautiful and diverse region.



Photos for the diary were provided by M. Janišová, J. Dengler, U. Jandt, R. Jaunatre, D. Ambarli and G. Filibeck