

Invitation to the 10th EDGG Field Workshop “Biodiversity patterns across a precipitation gradient in the Central Apennine mountains” Italy, 3-11 June 2016

Introduction

EDGG Research Expeditions have been carried out since 2009, when the first one was conducted in Romania (Dengler et al. 2009). The 2nd expedition, in 2010, went to Ukraine (Dengler et al. 2010), the 3rd to Bulgaria (Apostolova et al. 2011). In 2012, there were two such expeditions, one to Sicily (Guarino et al. 2012), and one to Greece (Dengler & Demina 2012). In 2013 the expedition reached Central Asia (Janišová et al. 2013). Since 2014, under the new name “Field Workshop”, the expeditions have taken place in Spain (Biurrun et al. 2014), Poland (Kącki et al. 2014) and Serbia (Dajić Stevanović et al., 2015).

The aims of these international workshops are to sample high-quality data on composition and biodiversity patterns of dry grasslands and related communities in understudied regions of the Palaearctic, to use these data for joint publications in international journals, and to exchange knowledge (species determination, field sampling, analytical methods) among participants with different background. A number of papers on ISI journals have already been published from some of the previous expeditions (Dengler et al. 2012a, Pedashenko et al. 2013, Turtureanu et al. 2014, Kuzemko et al. 2014, 2016, Polyakova et al. 2016); several other papers from various expeditions are in preparation (see also Dengler et al. 2016a for a comparative overview of the data collected so far).

The 10th EDGG workshop will take place from June 3rd to June 11th 2017 in Italy.

Philosophy and methodology of the EDGG workshops

The EDGG Field Workshops are *very intensive events* of typically 7–12 days duration, *restricted to a small group of highly motivated participants*. They contain a mixture of oral presentations, methodological discussions, and joint field sampling with advanced sampling methods. The core aims of the EDGG Field Workshops are knowledge exchange and capacity building among scientists from various countries

regarding planning of observational studies on multi-taxon biodiversity patterns (vascular plants, non-vascular plants, animals), species determination, field/statistical techniques, vegetation classification approaches and scientific writing.

The field data collected will subsequently be used for joint publications in ISI journals by the participants, which will be planned during the Field Workshop. Later they will contribute to publically accessible vegetation-plot databases (Database Scale-Dependent Phytodiversity Patterns in Palaearctic Grasslands, GIVD ID EU-00-003; Dengler et al. 2012b).

The sampling design is the same as that of the nine previous EDGG Research Expeditions/Field Workshops (and several other studies) to allow large scale comparisons (Dengler et al. 2016a). Its core points stem from a proposal by Dengler (2009). The up-to-date and detailed protocol has been recently published in this Bulletin (Dengler et al. 2016b). We use intensive nested plot sampling, covering plot sizes of 0.0001, 0.001, 0.01, 0.1, 1, 10 and 100 m², complemented by supplementary 10-m² plots. In both cases, all terricolous vascular plants, bryophytes and lichens are recorded, and for the 10-m² (sub-) plots also percentage cover of species and environmental data (slope, aspect, microrelief, soil depth) are noted, while a mixed soil sample to be analysed in the lab and biomass samples are collected. In the 10th field workshop, we are planning to introduce some methodological developments such as some simple quality assessment (QA) procedures, i.e. to obtain estimates of the average pseudo-turnover (generated by inherent inter-observer discrepancies) in the dataset and include the results of this in the subsequent publications. Although QA procedures may be very time-consuming, a reasonable trade-off could be double-sampling 10% of the 10-m² plots.

Suggestions from participants regarding additional data collection (such as trait measurements) and fieldwork that could be incorporated into the workshop programme are welcome and can be discussed with the organizers. We particularly encourage zoologists among our members to join in

order to sample invertebrate taxa on the same plots (e.g. snails, grasshoppers, etc.).

EDGG Field Workshops are open to EDGG members at any academic level. Particularly welcome are PhD students and young Postdocs who plan to do field sampling of grassland vegetation and wish to discuss their sampling ideas before they start.

Participants may optionally decide to give an oral presentation – this becomes mandatory only if you want to apply for an IAVS travel grant. There are three types of oral presentations: (1) key note lectures by the Workshop organizers on the study area and on sampling methodology; (2) presentations by participants about results from similar studies (10 min presentation + 5 min discussion); (3) presentations about concepts/methods of emerging studies (e.g. PhD projects) at early stages (10 min presentation + 15 min discussion). Presentations of methodological approaches in the field are also welcome.

The 10th Field Workshop of the EDGG

In 2017, the EDGG Field Workshop will take place in “Abruzzo Lazio & Molise” National Park and surrounding areas (Central Apennine mountains, Italy; approx. 100 km East of Rome, Fig. 1) from Saturday, June 3, to Sunday, June 11.

This event is organized by Goffredo Filibeck and Laura Cancellieri (University of Tuscia, Viterbo), supported by Marta G. Sperandii (University of Roma Tre) and with the kind help, for surveying some specific locations, of Anna Rita Frattaroli (University of L’Aquila) and other local scientific experts; and in cooperation with Jürgen Dengler (EDGG Executive Committee, University of Bayreuth & German Centre for Integrative Biodiversity Research) and Idoia Biurrun (EDGG Executive Committee, University of the Basque Country).

The main research aim will be sampling plant richness patterns across a continentality gradient. Because of rain-shadow effect, some inner valleys of Abruzzo (e.g. the Fucino basin and the Aterno valley) feature low precipitation values. This situation is somewhat similar to the well-known “dry valleys” of the Alps (e.g. Schwabe & Kratochwil 2004; Wiesner et al. 2015), but while in the Alps the precipitation regime is centred in summer, in the Central Apennines there is a sub-Mediterranean climate with summer drought or at least with a summer rainfall minimum (Gerdol et al. 2008; Blasi et al. 2014). The grassland vegetation in these Apennine inner basins is made up of a very interesting mixture between steppic (e.g. *Stipa capillata*, *Sideritis italica*, *Crocus reticulatus*, *Androsace maxima*, *Linum austriacum* subsp. *tommasinii*) and Mediterranean (e.g. *Artemisia alba*, *Convolvulus elegantis-*



Fig. 1. Study area position (white square).



Photo 1. Apennines “dry valleys”: old almond groves and pastures in the Fucino basin, at the foothills of Monte Velino massif. Photo: G. Filibeck.



Photo 2. *Phlomis fruticosa*, an Eastern-Mediterranean species found as a xerothermic relict near Pescina in the Fucino basin. Photo: M.G. Sperandii.

simum, *Hyparrhenia hirta*, *Phlomis fruticosa*, *Stipa capensis*) taxa, leading to high species richness.

Thanks to high-resolution interpolated climatic data provided by a leading research group in climatology (Michele Brunetti and coll., Institute of Atmospheric Sciences and Climate, Bologna), we will be able to sample grasslands across a very steep precipitation gradient: keeping both bedrock (limestone) and elevation (sub-montane belt, between c. 800-1200 m a.s.l.) constant, we will move from the above-described dry valleys (featuring a mean annual precipitation of 600-700 mm) to the W-facing “oceanic” slopes of the Apennines (precipitation 1300-1500 mm/yr). The whole gradient is often compressed in less than c. 15 km in a straight line.

Our vegetation sampling will be complemented by entomological sampling performed by two specialists of *Auchenorrhyncha* (leafhoppers and planthoppers). Experts of other invertebrate taxa that are appropriate to be sampled within vegetation quadrats are welcome to join.

Preliminary itinerary (Fig. 2)

June 3: Meeting the group at Rome Fiumicino airport (meeting time will probably be 12 noon). Transfer by minibus to Pescara (Fucino basin, Abruzzo). Hotel check-in, then move to a nearby dry grassland area for protocol explanation, methodological discussion, floristic training and “calibration” of the participants with simulated plots. In the evening, keynote presentations about study area in the hotel meeting room. Night in Pescara.

June 4: Field work in L’Aquila basin grasslands (very low-rainfall area with rare steppic relicts). Night in Pescara.

June 5: Field work in the Monte Velino foothills (low- to intermediate-rainfall area, with both steppic relicts and Mediterranean extrazonal species). In the evening, first round of participants’ presentations. Night in Pescara.

June 6: Field work in the Fucino basin grasslands (low-rainfall area with both steppic relicts and Mediterranean extrazonal species). Night in Pescara.

June 7: Hotel check-out. Field work in the Marsica range (low to intermediate level of rainfall). Drive to Opi, hotel check-in. Possible meeting with National Park scientific staff and/or local media in Pescasseroli (main town of the Park). In the evening, mid-workshop assessment/calibration of methodological issues. Night in Opi.

June 8: Field work near Pescasseroli (high rainfall area), comparing different types of bedrock (conglomerates vs. limestone s.s.; further possible comparison with clayey substrata); if there is time, field work in ancient wooded pastures (“Difesa”). In the evening, more participants’ presentations. Night in Opi.

June 9: Field work in the Lazio Apennines (high rainfall, oceanic sub-Mediterranean climate). Night in Opi.

June 10: Field work in the Lazio Apennines (high rainfall, oceanic sub-Mediterranean climate). Night in Opi.

June 11: Transfer by minibus to Rome Fiumicino Airport (we should be there by 1 p.m.).

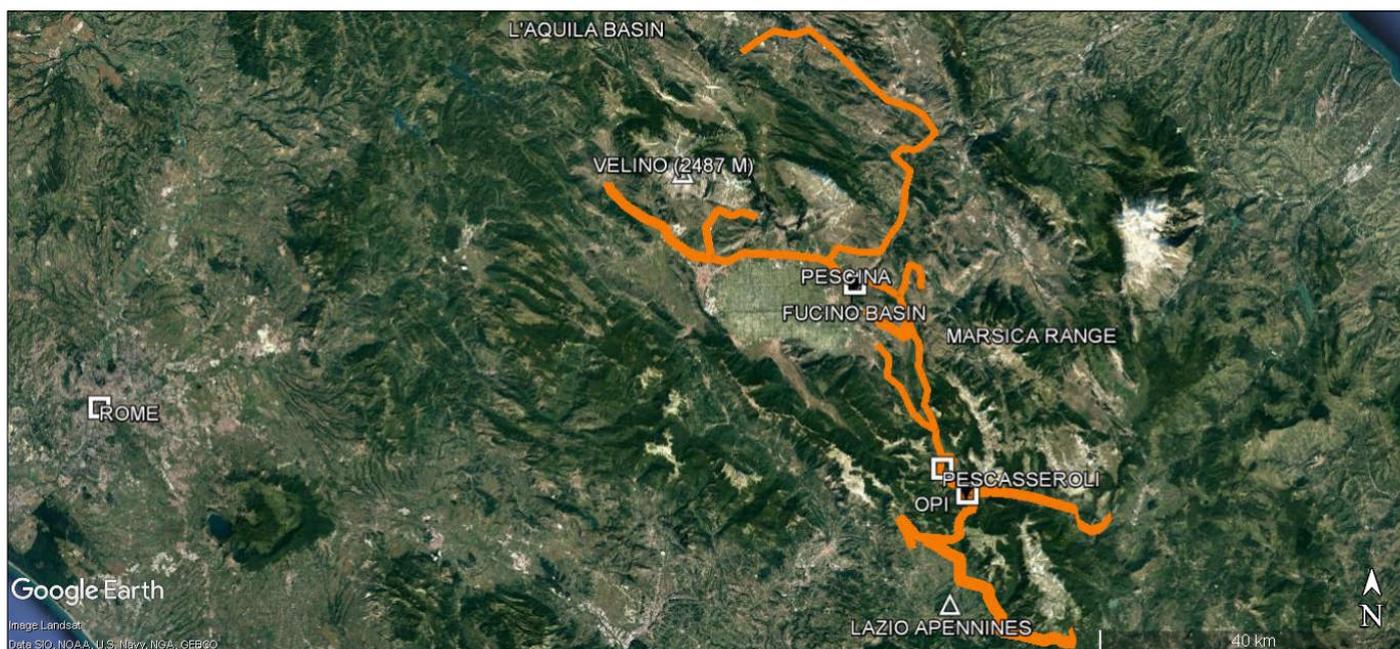


Fig. 2. Study area with position of main places mentioned in the itinerary; orange lines show the itinerary routes.



Photo 3. A grassland dominated by *Stipa dasyvaginata* subsp. *apenninica* (foreground) near Pescina (where we will stay on the first 4 nights), in the low-rainfall section of the study transect. In the background, above the cultivated valley bottom, the mountain slopes are covered with chamaephyte-rich grasslands (the yellow patches are massive carpets of *Helianthemum oleandicum* subsp. *incanum*). Photo: G. Filibeck.

How to register

There are 13 available places (in addition to the organizers) to join this research workshop. Participants from any country and any academic level (BSc student to professor) are welcome. We particularly appreciate the participation of people experienced in any of the following fields: bryophytes or lichens identification; identification of critical vascular plants; experience in high-quality field sampling; advanced statistical methods for biodiversity patterns; zoologists who are willing



Photo 4. A goat-grazed grassland on steep limestones at 1100 m a.s.l. in a high-rainfall sector of the study gradient, near the hilltop village of Opi (where we will stay on the last 4 nights) in Abruzzo. Photo: G. Filibeck.

and able to sample a certain invertebrate taxon during the field workshop on exactly the same plots used for vegetation.

Estimated costs: 660 Euros, including accommodation (sharing twin rooms), full meals (from dinner of the first day to breakfast on the last day), ground transport from arrival at Rome Fiumicino airport until departure from the same place (participants arriving by train to Roma Termini railway station can easily reach the airport by shuttle train “Leonardo Express”). The exact price will be confirmed later to those who will place a pre-registration (we are currently negotiating some financial support, so we might be able to reduce it by c. 100 Euros). *It is also possible to apply for financial support for participation* (travel grants, see below), although this requires membership of the IAVS.



Photo 5. The relatively oceanic, sub-Mediterranean slopes of the submontane belt in the Lazio Apennines: grassland patch with *Bromus erectus*, *Koeleria splendens*, *Phleum hirsutum* subsp. *ambiguum*, *Erysimum pseudorhaeticum*, *Artemisia alba*, *Silene otites*, *Anthyllis vulneraria*, etc. Photo: G. Filibeck.

Very important: EDGG Field Workshops are intensive field sampling events, aimed at collecting data to be analysed and published, not guided botanical excursions! Please be aware that the daily schedule will be very busy, because of the time-consuming sampling methodology in the field, followed by the oral presentations and “laboratory work” when back at the hotel (plant determination, preparation of herbarium specimens, soil sample preparation, etc.).

If you are interested in participating and would like to be kept informed about further details (e.g. the exact cost and the final itinerary) you should pre-register sending an e-mail to both the following persons: Goffredo Filibeck (filibeck@unitus.it) and Jürgen Dengler (juergen.dengler@uni-bayreuth.de).

However, *formal applications to participate must be sent no later than 15 March 2017* to the same two email addresses as

specified above. Please give as subject of your application e-mail "EDGG Field Workshop 2017" and provide the following personal information: full name, gender, age, academic degree/position, affiliation, email and post address, and which previous EDGG expeditions (if any) you have already participated to. Please also indicate in your application if you have any special dietary requirements. Those who are participating for the first time in an EDGG Field Workshop, are kindly required to attach a short motivation letter (approx. 10 lines), stating your interests and competences and explaining why you wish to participate in the Workshop, what you would contribute to its success (including any subsequent publications, e.g. knowledge of critical taxa or of analytical methods or additional ideas for field sampling) and what you would like to gain from your participation. Finally, if you wish to give an oral presentation, please attach, in a separate Word document, a half-page abstract and indicate whether this presentation belongs to category 2 or 3 (see details above). If there are more applications for participation than available places, the organizers will make a selection based on the information provided by you. Notification of acceptance (or otherwise) will be sent to applicants before 31 March 2017.

Application for IAVS travel grants

With your application to participate, you can also apply for IAVS travel grants that can cover part of your workshop fee and/or travel costs. Application for IAVS travel grants is possible until 15 March 2017 and only if you are an IAVS member in 2017 (for many countries, free or reduced membership is available, see <http://www.iavs.org/AwardsFinancial.aspx>) and give a presentation during the Field Workshop.

To apply for travel grants, please send us a Word document labelled „Application for IAVS travel grant“, that in addition to the information required for all participants contains/repeats the following items:

- your name;
- title and type of your presentation;
- specification that you are IAVS member in 2016;
- estimated costs of travel to and from Rome;
- information whether you receive other funding;
- whether your participation is only possible with financial support;
- whether you are also applying for financial support to attend the 2017 EDGG conference in Latvia and Lithuania, the 2017 EVS workshop in Spain or the 2017 IAVS Symposium in Sicily (you can normally receive financial support for only one

of these meetings and therefore have to indicate your preference).

The decision on travel grants and the amount of money awarded to each of the scholars will be made by the EDGG Executive Committee in consultation with the IAVS Global Sponsorship Committee. Applicants will be notified about the decision by approx. 15 April 2017.

The study area

i. General features

Our research expedition will take place within the Central Apennine mountains (Italy), in the administrative regions of Abruzzo and Lazio. Most of the surveyed sites will be inside "Abruzzo Lazio & Molise National Park" or its buffer area. On a couple of days, we shall work in different districts, namely at the foothills of the Monte Velino massif and in the L'Aquila basin, lying at the base of the Gran Sasso chain. The Central Apennines host the highest peaks of Italy south of the Alps (Gran Sasso reaches 2,912 m a.s.l.); however, because of our research aim (and because of the period of the year) we will focus on the submontane belt, i.e. we will work mainly in grasslands placed between 700 and 1200 m a.s.l.

Prevailing bedrock types are Mesozoic limestones and dolomites; conglomerate, calcareous arenite, clay and marl substrata also occur. Geomorphology is characterized by widespread karstic landforms. Climate is sub-Mediterranean in the colline and submontane belts, i.e. showing a marked but short summer drought period. From the montane belt upwards, in the Apennines the reduced summer temperatures and the orographic rain give rise to a climate which is formally classified as Temperate by many Authors (e.g. Rivas-Martinez et al. 2004; Blasi et al. 2014), because of the lack of a drought period if defined according to the threshold $P < 2T$. However, it is to be underlined that even at high elevation the precipitation regime in the Apennines is very different from that of the Alps or Central Europe, as it features a deep minimum in summer and a maximum in autumn (while in the Alps at the same elevation there is a marked precipitation maximum in summer) (Gerdol et al. 2008; Filibeck et al. 2015). Thus, in the Apennines, herbaceous plants in the montane and even the subalpine belt can be under severe drought stress during July and August (Primi et al. 2016). This limiting factor leads to a grassland physiognomy that is often very different to analogous formations in the Alps: Apennines grasslands host – along with hemicryptophytes familiar to C-European botanists such as *Bromus erectus*, *Nardus stricta* or *Dactylis glomerata* – a number of Mediterranean therophytes as well as xeromorph or succulent chamaephytes.

The core section of our study area was designated as a National Park in 1923, for protecting the local endemic subspecies of bear (*Ursus arctos* subsp. *marsicanus*) and chamois (*Rupicapra pyrenaica* subsp. *ornata*). The area also hosts a large population of wolf (*Canis lupus*), while red deer (*Cervus elaphus*) was reintroduced in the 1970's. The Park's flora comprises >2,000 species, including 137 taxa endemic to Italy, 29 of which are endemic to the Central Apennine mountains. A total of c. 65 boreal, central-European or arctic-alpine plant taxa reach here the southernmost point of their Italian range (e.g. *Aster alpinus*, *Cypripedium calceolus*, *Dactylorhiza fuchsii*, *Pinus mugo*, *Trollius europaeus*, *Vaccinium myrtillus*) (Conti & Bartolucci 2015).

Transhumant sheep and goat grazing was the main stocking system in the Central Apennines for millennia (Manzi 2012). Within the study area, it dates back to the 6th century BC or earlier (Brown et al. 2013), and was widely practiced until the 1950's, when ovine grazing started to dramatically decrease for the same socio-economic reasons as in other parts of Europe, such as mountain depopulation, etc. Thus, while in central Europe transhumant shepherding and the associated secondary dry grasslands are relatively recent phenomena (e.g. Poschold & Wallis DeVries 2002), sheep grazing was shaping Apennine landscapes already in Roman times: the floristic composition of present-day secondary grasslands of the Apennine mountains may thus be inherited from local xerothermic enclaves, that survived through the postglacial forest spread as relicts of the previously widely distributed steppe. The abandonment of traditional sheep grazing in the Apennines is now leading to grassland habitat loss because of scrub encroachment and forest expansion (Bracchetti et al. 2012); however, in our study area, secondary dry grasslands still occupy a very large proportion of the landscape.

Most of the husbandry is now sedentary, and present-day stocking rate is drastically lower than in the early twentieth century (Primi et al. 2016). The most common stocking system now involves grazing from mid-June to mid-October in public pasturelands, leased by each municipality to individual farmers. However, also common pastures exist, where all local residents are entitled to introduce their animals upon payment of a fee. The shepherds lead the sheep or goat herd to the assigned pastures and remain with them. In the evening the herd is gathered for milking, and spends the night in a fenced area for protection against wolves. In the last decades the abandonment of sheep husbandry has been followed by a steep increase in bovine and, above all, equine grazing. Since most of the cattle and horses belong to "part-time farmers" (i.e., people who have their main income from other professional activities), they are usually raised for meat production only and are left free-ranging in the wild without checking for many months (Primi et al. 2016).

ii. The climate gradients and the main vegetation patterns

Our study area features a peculiar gradient in total annual rainfall (and, to a lesser extent, in annual temperature excursion). The inner tectonic basins of Abruzzo are under a rain-shadow effect, thus showing mean annual precipitation of c. 600 mm; on the other hand, the W-facing slopes of the ridge between Lazio and Abruzzo can receive more than 1700 mm/yr. The distance between the two extremes can be smaller than 15 km. This specific local gradient interacts with the more general gradients that are characteristic in the Italian Peninsula, i.e. a gradient of decreasing temperature with increasing elevation and a gradient of decreasing Mediterranean influence (decreasing length and strength of the summer drought) moving away from the coast.

In the low-rainfall basins, potential vegetation is thought to be *Quercus pubescens* forest (Pirone et al. 2010): the relatively continental climate allows this species to span over an unusually large elevation range (from 400 to 1400 m a.s.l., while in the rest of central Italy it is usually restricted to the colline belt, i.e. <800 m a.s.l.). In these dry valleys, fragments of extrazonal *Quercus ilex* woods also exist.

Instead, the areas with high annual rainfall show a forest vegetation dominated by *Ostrya carpinifolia* and/or *Quercus cerris* in the colline and submontane belt, i.e. below 1200 m a.s.l. (mean annual temperature >10 °C and only limited frost occurrence). In the montane belt, i.e. above 1200 m a.s.l. (mean annual temperature between 6-9 °C, with significant winter frost), the forest vegetation is made up almost exclusively of *Fagus sylvatica* (Filibeck et al. 2015). The natural timberline is reached at approx. 1900 m, but the actual tree line is often lower because of centuries of sheep grazing. Above the potential timberline lies the subalpine belt, characterized by prolonged snow cover and late-spring frost; this belt is covered mainly with grasslands, fragments of prostrate shrub vegetation (mainly *Juniperus communis* subsp. *nana*, rarely *Pinus mugo*), rocks and screes.

In the study area, grasslands show a huge heterogeneity in both physiognomy and floristic composition, depending on elevation belt, precipitation regime, bedrock, landforms, soil depth, historical land-use, etc. Generally speaking, most frequent species include (Primi et al. 2016; Cancellieri et al. 2017) *Festuca circummediterranea*, *Bromus erectus*, *Brachypodium rupestre*, *Koeleria splendens*, *Avenula praetutiana*, *Phleum hirsutum* subsp. *ambiguum* among grasses, and *Cerastium tomentosum*, *Viola eugeniae*, *Hieracium pilosella*, *Anthyllis vulneraria* among forbs.

In the "dry valleys", grasslands can be dominated by species ecologically bound to a continental climate and interpreted as steppe relicts, such as *Stipa capillata*, *Stipa dasyvaginata*



Photo 6. A stony slope in the dry sector of the Marsica range, with an open formation dominated by chamaephytes such as *Satureja montana*, *Sideritis italica*, *Helianthemum oleandicum* subsp. *incanum*, *Globularia* spp., and with *Polygala major*, *Bromus erectus*, *Koeleria splendens*, etc. Photo: G. Filibeck.

subsp. *apenninica*, *Sideritis italica* (= *S. syriaca* p.p.) (e.g. Tammaro 1984). Here also some very disjunct populations of rare steppic species occur, the most striking being *Goniolimon italicum*, a narrow endemic known solely from the L'Aquila basin and the only W-European species of a typically steppic genus (Morretti et al. 2015); other examples of disjunct populations include (see e.g. Tammaro 1995; Conti & Bartolucci, 2015) *Androsace maxima*, *Crocus reticulatus*, *Alyssum desertorum*, *Salvia aethiopsis* and *Astragalus exscapus*: the latter was until now known in Italy for the Alpine dry valleys only, and has been discovered for the first time in the Apennines in 2016 (Cancellieri et al., in prep.) during a preparatory field trip for this EDGG Workshop! Interestingly, intermixed with these steppic taxa there is often a number of Mediterranean species: e.g. *Helichrysum italicum*, *Salvia argentea*, *Stipa capensis*. The stony slopes are often colonized by grasslands rich in chamaephytes (*Satureja montana*, *Globularia* spp., *Helianthemum* spp., *Thymus longicaulis*, *Chamaecytisus spinescens* etc.) or even pseudo-garrigues (Pirone & Tammaro 1997). Some grasslands are encroached with E-Mediterranean small shrubs such as *Phlomis fruticosa*, *Salvia officinalis*, *Daphne sericea*.

In the high-rainfall area on the Abruzzo side of the watershed, the secondary grasslands of the submontane and montane slopes on limestones are usually dominated by *Festuca circummediterranea*, *Koeleria splendens*, *Bromus erectus*, *Poa bulbosa* and *Avenula praetutiana*, and very frequent species include *Phleum hirsutum* subsp. *ambiguum*, *Hieracium pilosella*, *Helianthemum* spp., *Minuartia verna*, *Anthyllis vulneraria*, *Arenaria serpyllifolia*, *Cerastium tomentosum*, *Sedum*

rupestre, *Thymus longicaulis*, *Euphorbia myrsinites*, *E. cyprissias*, *Achillea millefolium* agg., *Viola eugeniae* subsp. *eugeniae*. The bottom of karst depressions feature a more acidophilic and mesophytic vegetation, with *Nardus stricta*, *Festuca* sect. *Aulaxyper*, *Agrostis capillaris*, *Plantago atrata*, *Trifolium repens*, *Potentilla rigoana*. Conglomerates feature an interesting xerophilous flora with *Sedum* spp., *Alyssum alyssoides*, *Saxifraga tridactylites*, *Erophila verna*, *Hornungia petraea*, *Paronychia kapela*. Clayey substrata are dominated by *Brachypodium rupestre*, with *Dorycnium pentaphyllum*, *Polygala nicaeensis*, *Trifolium ochroleucon* (Primi et al. 2016; Cancellieri et al. 2017). An interesting feature of the lower montane belt in the surroundings of Pescasseroli and Opi are the wooded pastures, locally called "Difese" (similar to the "Dehesas" in Spain) (Manzi 1990). The slopes of the Lazio side of the National Park (i.e. the SW aspect of the Apennine chain) can feature even higher values of total annual rainfall than the Abruzzo side, but at the same time have lower summer precipitation, i.e. a more Mediterranean climatic character. Thus, the floristic composition of the submontane belt shows an interesting mixture between *Festuco-Brometea* (or its Apennine vicariant) taxa, shared with the Abruzzo sector of the Park (mostly hemicryptophytes: e.g. *Festuca circummediterranea*, *Bromus erectus*, *Phleum hirsutum* subsp. *ambiguum*, *Hieracium pilosella*, *Anthoxanthum odoratum*, *Vincetoxicum hirundinaria*), and Mediterranean species (mostly therophytes, belonging to *Helianthemetea guttati*; but also chamaephytes from *Ononido-Rosmarinetea* and geophytes) such as *Trachynia dystachia*, *Dasypyrum villosum*, *Trifolium stellatum*, *Euphorbia spinosa*, *Helichrysum italicum*, *Ruta graveolens*, *Asphodeline lutea*, etc.

In the subalpine belt (that will not be reached by our expedition) most slopes are covered with communities dominated by *Festuca circummediterranea*, *F. laevigata* subsp. *laevigata*, *F.* sect. *Aulaxyper*, *Avenula praetutiana*, *Koeleria lobata* and *Poa alpina*. On shallower soils, the subalpine grasslands are dominated by *Sesleria juncifolia* subsp. *juncifolia* (Primi et al. 2016).



Photo 7. *Asphodeline lutea* flowering in the sub-Mediterranean grasslands in the "oceanic" part of our study gradient (submontane belt, Lazio sector). Photo: M.G. Sperandii.



Photo 8. *Crepis lacera* (endemic to Italy and typically found in montane and submontane grasslands). Photo: G. Filibeck.

Especially at lower elevation, secondary grasslands are rich in orchids: many of them are of conservation interest, such as *Himantoglossum adriaticum*, *Epipactis atrorubens*, *Ophrys apifera*, *Orchis pauciflora*, *O. provincialis*, *O. tridentata*, *O. ustulata*. Endemic species include e.g. *Crepis lacera* (very common), *Iris marsica*, *Paeonia officinalis* subsp. *italica*, *Viola eugeniae* (Conti & Bartolucci 2015).

iii. Previous studies

The grassland vegetation of the C-Apennines dry valleys (Fucino basin, L'Aquila basin, Capecstrano valley, Giovenco valley, etc.) still needs to be thoroughly explored, however a few descriptive studies have underlined some of the characters of their peculiar grasslands: for instance, Avena & Blasi (1979) described the most common associations in the Fucino basin, Pirone & Tammara (1997) provided a phytosociological description of the chamaephytic communities of the various dry valleys, Tammara (1984) described the *Stipa capillata*-dominated vegetation, Tammara (1995) provided a phytosociological description of the southern slopes of Gran Sasso, Pirone et al. (2001) described some grassland communities in

the Capecstrano valley. Preliminary results from a detailed study on the altitudinal biodiversity patterns of the Monte Velino grasslands are presented by Theurillat et al. (2007).

The grasslands of the submontane and montane belt of Abruzzo National Park are not very well known (this is even more so for the Lazio sector of the Park). A preliminary phytosociological study on the submontane grasslands of a very small area of the Park was published by Biondi et al. (1992). Other relevés from the montane belt of the Park are published and discussed in a general study on the *Festuco-Brometea* in the C-Apennines by Lucchese et al. (1995). For the meso- and hygrophytic grasslands on the alluvial soils of the Pescasseroli valley see Pedrotti et al. (1992). The acidophilous grasslands (although mostly in the upper-montane and subalpine belt) of the NE-buffer area of the Park were studied in detail by Di Pietro et al. (2005). The grasslands of the Park's subalpine belt (not involved in this Field Workshop) were described in the very detailed study by Bazzichelli & Furnari (1979). Primi et al. (2016) recently published a general description of the physiognomic features of all the Park's grasslands, as well as an analysis of their phenological and productivity patterns through remote-sensing and a preliminary analysis of the relationship between species richness and grazing pressure (and between species richness and altitude). A biodiversity study in the montane belt of the Park's core area, based on randomized nested plots similar to those used in the EDGG approach (but only the 0.01, 0.1 and 1 m² spatial scales were surveyed), will be published in the near future (Filibeck et al. in prep.); some preliminary results can be found in Cancellieri et al. (2017).



Photo 9. *Paeonia officinalis* subsp. *italica* is found in some dry pastures of the Marsica range. Photo: L. Cancellieri.

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Photo 10. Old almond grove in a dry valley (Fucino basin) now used as extensive pasture and encroached with *Helichrysum italicum*. Photo: G. Filibeck.