International Workshop

Phytodiversity of Palaearctic grasslands

6–10 March, Bayreuth

Funding

BayIntAn application 7 November 2016 Dengler et al. (funded by the Bayerische Forschungsallianz, BayIntAn_UBT_2017_58)

Long title (German)

Nutzung standardisierter Phytodiversitätsdaten verschiedener räumlicher Skalenebenen von Grasländern der Paläarktis zur Bearbeitung fundamentaler Fragen der Biodiversitätsforschung und Gemeinschaftsökologie: Workshop zur Initiierung gemeinsamer Publikationen

Long title (English translation)

Addressing fundamental questions of biodiversity research and community ecology with a large database of standardized phytodiversity data of Palaearctic grasslands at various spatial scales: Workshop to start overarching projects and publications

Workshop

6–10 March at the campus of the University of Bayreuth, Bayreuth, Germany

PI

Jürgen Dengler (Bayreuth, DE)

Workshop participants

Alireza Naqinezhad (Babolsar, IR), Goffredo Filibeck (Viterbo, IT), Idoia Biurrun (Bilbao, ES), Iwona Dembicz (Bayreuth, DE/Warsaw, PL), Manuel Steinbauer (Aarhus, DK), Monika Janišová (Banska Bystrica, SK), Riccardo Guarino (Palermo, IT),Santiago Soliveres (Bern, CH/ES), Steffen Boch (Bern, CH/DE), Viktoria Wagner (Brno, CZ/Graz, AT), Timo Conradi (Aarhus, DK), David Storch (Prague, CZ), Itziar García-Mijangos (Bilbao, ES).

Working group members who participate remotely

Alessandro Chiarucci (Bologna, IT), Salza Palpurina (Brno, CZ), Steffen Boch (Bern, CH).

Optional additional participants

If you are interested to join the workshop, you can contact juergen.dengler@uni-bayreuth.de.

Detailed description English

Understanding the unequal distribution of species diversity in space is one of the greatest challenges in ecology. Standardized sampling protocols for diversity assessments are therefore essential to reflect diversity patterns across spatial scales and to compare the diversities of different ecosystems. Palaearctic grasslands harbour a high diversity of various taxa (Allan et al. 2014) and hold the majority of world records in vascular plant species richness for grain sizes smaller than 100 m² (Wilson et al. 2012). In addition, the diversities of bryophytes and lichens, which are a fundamental driver of ecosystem functioning in many ecosystems (Lindo & Gonzalez 2010), can also be high in these habitats (Boch et al. 2016; Dengler et al. 2016a). There are also particularly species-poor types among Palaearctic grassland (Dengler et al. 2016a). These three points together make Palaearctic grasslands an excellent model system to analyse diversity patterns and their underlying drivers. The acquisition of knowledge on these topics is of great importance in the development of appropriate conservation measures and in order to maintain these highly diverse ecosystems and the ecosystem functions they provide (Soliveres et al. 2016).

The majority of studies analysing the effects of abiotic, biotic and historical factors on any aspect of biodiversity (species richness, phylogenetic diversity, functional diversity) focus on a single spatial scale. Coarse-grain studies (hundreds to thousands of square kilometres) focus on macro-ecological patterns, rarely considering biotic interactions, and their interplay with abiotic conditions, as drivers of general biodiversity patterns (Beck et al. 2012; Wisz et al. 2013). This narrow focus prevents us from gathering as more general knowledge regarding the drivers of biodiversity at contrasting spatial scales and the mechanisms driving community assembly. Fine-grain studies (< 100 m2) focus on the role of biotic interactions and habitat filtering on the local composition of species, but rarely allow us to test to which extent these assembly processes are important, and how much local assemblies influence large biogeographical patterns. The prevailing drivers of biodiversity vary strongly between grain sizes (Shmida & Wilson 1985; Siefert et al. 2012). Multi-scale studies would allow testing to what degree to biotic interactions matter for community assembly, and at which scales does sensitivity to environmental changes peak. However, analyses across contrasting spatial grain sizes are very rare and mainly restricted to the local to regional spatial extents, while studies over broad biogeographic extent are impeded by the idiosyncrasies of the plot sizes and sampling schemes used.

Bearing these aspects in mind, the Eurasian Dry Grassland Group (EDGG; www.edgg.org), a network of more than 1000 grassland ecologists from over 60 countries, started in 2009 annual field expeditions for sampling high-quality multi-scale phytodiversity data of natural and semi-natural grasslands along ecological gradients in understudied regions of the Palaearctic biogeographic realm (i.e. Europe, North Africa, temperate Asia). Nine expeditions have been conducted so far (2009: Transylvania, Romania; 2010: Podolia, Ukraine; 2011: NW Bulgaria; 2012: Sicily; 2012: NW Greece; 2013: Khakassia, Siberia; 2014: Navarre, Spain; 2015: S Poland; 2016: Serbia; see Dengler et al. 2016a). These expeditions have been supported by small-scale funding from various sources, including some money from BayIntAn for those in Navarre (2014) and Serbia (2016), and use the same sampling protocol based on Dengler (2009b; for details, see Dengler et al. 2016b). Dengler et al. (2016a) list further 11 regional projects that largely use the same methodology. Taken together, this results in a highly consistent dataset spanning major biogeographic gradients of the Palaearctic biogeographic realm and including e.g. 1795 1-m² plots and 1109 10-m² plots.

The datasets from individual regions have given rise to a series of publications, dealing with vegetation classification (e.g. Kuzemko et al. 2014), species-area relationships (Dengler 2006; Dengler & Boch 2008), and taxon- and scale dependence of diversity-environment relationships (Löbel et al. 2006; Turtureanu et al. 2014; Kuzemko et al. 2016; Polyakova et al. 2016). However, conducting such analyses with the combined data across the whole biogeographic realm can be even more insightful as it allows distinction between general ecological patterns and regional idiosyncrasies in the style of a "coordinated distributed experiment" (Fraser et al. 2013), as e.g. in Palpurina et al. (in press).

The efforts for joining all the data into a single, harmonized database as well as the statistical complexity of potential analyses have so far prevented to use the datasets in combined analyses across the whole biogeographic realm. A group from the EDGG expeditions have thus decided this year to make a major attempt to overcome these impediments, resulting already in two overview papers (Dengler et al. 2016a, b). In parallel, I. Biurrun and J. Dengler have started to search for additional compatible high-quality datasets from other researchers. Feedback makes us optimistic that within a few months we can double the number of available plot data, while at the same time increasing the coverage along ecological and biogeographic gradients. However, to finally achieve a harmonized database of multi-scale community composition data together with in-situ measured environmental data across the studied grasslands still requires significant work. To finalise the database, to plan exciting research and to develop grant proposals to ensure funding of that could best be achieved bringing together the relevant key players for an intensive workshop. Moreover, the prospect for joint high-impact papers could be a major incentive for other researchers to contribute their data to our database.

We thus propose a **5-day workshop in Bayreuth in March 2017** to

(a) **finalise the database**,

(b) **write up a first (descriptive) paper** describing the content and opportunities of the common database (similar to the database paper on the global trait database TRY; Kattge et al. 2011),

(c) **plan analytical approaches and paper projects** using the database alone and in combination with other large databases (see below),

(d) **carry out some proof-of-principle analyses** to demonstrate the suitability of the data for these,

(e) **identify opportunities to attract third-party funding** for such projects and start drafting grant proposals and

(f) **plan the further expansion of the database** (find existing suitable data, collect field data to fill important gaps).

This format of workshops are extraordinarily effective, proved in the "Synthesis" workshops of the German Centre of Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig

(https://www.idiv.de/en/sdiv/working_groups.html), one of which J. Dengler just coordinated as PI (https://www.idiv.de/en/sdiv/working_groups/wg_pool/splot/meeting_iii.html).

Many **hot research topics could be addressed with the EDGG database** alone or in combination with various global and European datasets, like the gap-filled version of the global plant trait database (TRY; Kattge et al. 2011), the Global Naturalized Alien Flora database (GloNAF; van Kleunen et al. 2015), high resolution climate data (CHELSA; http://www.systbot.uzh.ch/de/Personen/PostdoktorandInnen/DirkKarger/Chelsa.html), landuse (CORINE) and other new/emerging GIS and remote sensing products:

(1) **Scale- and taxon-dependent patterns and drivers of biodiversity** across Palaearctic grasslands. Such an overarching analysis would allow to identify commonalities and idiosyncrasies of the individual regions, and to address much better than it was possible in regional studies the effects of macroclimate, regional species pool, landscape configuration and landscape history.

(2) **Species-area relationships** and how their function types and parameters are affected by grassland type, land-use and ecological factors (see Dengler 2009a).

(3) **Relationships between species, phylogenetic and functional diversities** and their decomposition into alpha-, beta- and gamma-components.

(4) **Relationship of niche widths of species in relation to their niche optima and possible changes of niche characteristics from range centres to range margins** (e.g. Wagner et al. in press).

(5) **Relative importance of environmental filtering (resulting in trait convergence) and limiting similarity (resulting in trait divergence)** at different spatial scales (this is to be expected, Brunbjerg et al. 2014, but could not be shown with multiscale datasets of the same plots so far).

(6) **Relationship of community-weighted means (CWMs) and trait diversity to major resource and stress gradients** (has been analysed with small number of plots along local or regional scales, e.g. Bernard-Verdier et al. 2012, but never with community data at continental extent).

We intend to use the expertise of all participants during the workshop to **identify the most promising grant application strategies**, including the following:

- DFG “Normalverfahren” and DFG Research Group, possibly combined with a DFG Heisenberg application of J. Dengler.
- DAAD grants to allow exchange of individual PhD students to work on specific publication as well as to conduct new regional studies with the common approach in understudied regions with co-supervision of members of the group from abroad.
- It is likely that the next BiodivERsA call in the ERA-Net European funding call will have a topic that could be nicely addressed with EDGG dataset and thus allow the consortium to apply for a pan-European grant.

- Publishing our database paper and a first overarching analytical paper in renowned international journals might also attract external researchers to collaborate with us and make use of our valuable and unique dataset in joint grant proposals.

References to sources cited in the "Detailed description"

Allan, E., Bossdorf, O., Dormann, C.F., Prati, D., Gossner, M.M., Tscharntke, T., Blüthgen, N., Bellach, M., Birkhofer, K., (...) & Fischer, M. 2014. Inter-annual variation in land-use intensity enhances grassland multidiversity. *Proceedings of the National Academy of Sciences of the USA* 111: 308–313.

Beck, J., Ballesteros-Mejia, L., Buchmann, C.M., Dengler, J., Fritz, S., Gruber, B., Hof, C., Jansen, F., Knapp, S., (…) & Dormann, C.F. 2012. What's on the horizon for macroecology? *Ecography* 35: 673–683.

Bernard-Verdier, M., Navas, M.-L., Vellend, M., Violle, C., Fayolle, A., Garnier, E. 2012. Community assembly along a soil depth gradient: contrasting patterns of plant trait convergence and divergence in a Mediterranean rangeland. *Journal of Ecology* 100: 1422–1433.

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

Brunbjerg, A.K., Cavender-Bares, J., Eiserhardt, W.L., Ejrnæs, R., Aarssen, L.W., Buckley, H.L., Forey, E., Jansen, F., Kattge, J., Lane, C., Lubke, R.A., Moles, A.T., Monserrat, A.L., Peet, R.K., Roncal, J., Wootton, L., Svenning, J.-C. 2014. Multi-scale phylogenetic structure in coastal dune plant communities across the globe. *Journal of Plant Ecology* 7: 101–114.

Dengler, J. 2006. Variabilität von Artendichte und Artenzusammensetzung auf unterschiedlichen räumlichen Skalenebenen – Exemplarische Untersuchungen aus Trockenrasen und Konsequenzen für das Probedesign von Biodiversitätsuntersuchungen. *Arbeiten aus dem Institut für Landschaftsökologie Münster* 15: 73–81.

Dengler, J. 2009a. Which function describes the species-area relationship best? – A review and empirical evaluation. *Journal of Biogeography* 36: 728–744.

Dengler, J. 2009b. A flexible multi-scale approach for standardised recording of plant species richness patterns. *Ecological Indicators* 9: 1169–1178.

Dengler, J. & Boch, S. 2008. Sampling-design effects on properties of species-area curves – A case study from Estonian dry grassland communities. *Folia Geobotanica* 43: 289–304.

Dengler, J., Biurrun, I., Apostolova, I., Baumann, E., Becker, T., Berastegi, A., Boch, S., Dembicz, I., Dolnik, C., Ermakov, N., Filibeck, G., Garcia-Mijangos, I., Giusso del Galdo, G., Guarino, R., Janišová, M., Jensen, K., Jeschke, M., Kącki, Z., Kozub, Ł., Kuzemko, A.A., Löbel, S., Pedashenko, H., Polyakova, M., Ruprecht, E., Szabó, A., Vassilev, K., Velev, N., Weiser, F. 2016a. Scale-dependent plant diversity in Palaearctic grasslands: a comparative overview. *Bulletin of the Eurasian Dry Grassland Group* 31: 12−26.

Dengler, J., Boch, S., Filibeck, G., Chiarucci, A., Dembicz, I., Guarino, R., Henneberg, B., Janišová, M., Marcenò, C., Naqinezhad, A., Polchaninova, N.Y., Vassilev, N., Biurrun, I. 2016b. Assessing plant diversity and composition in grasslands across spatial scales: the standardised EDGG sampling methodology. *Bulletin of the Eurasian Grassland Group* 32: 13−30.

Fraser, L.H., Henry, H.A.L., Carlyle, C.N., White, S.R., Beierkuhnlein, C., Cahill, J.F. jr., Casper, B.B., Cleland, E., Collins, S.L., Dukes, J.S., Knapp, A.K., Lind, E., Long, R., Luo, Y., Reich. P.B., Smith, M.D., Sternberg, M., Turkington, R. 2013. Coordinated distributed experiments: an emerging tool for testing global hypotheses in ecology and environmental science. *Frontiers in Ecology and the Enviroment* 11: 147−155.

Kattge, J., Díaz, S., Lavorel, S., Prentice, I.C., Leadley, P., Bönisch, G., Garnier, E., Westoby, M.W., Reich, P.B., Wright, I.J. (…) & Wirth, C. 2011. TRY – a global database of plant traits. *Global Change Biology* 17: 2905–2935.

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

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

Lindo, Z., Gonzalez, A. 2010. The bryosphere: an integral and influential component of the Earth's biosphere. *Ecosystems* 13: 612−627.

Löbel, S., Dengler, J. & Hobohm, C. 2006. Species richness of vascular plants, bryophytes and lichens in dry grasslands: The effects of environment, landscape structure and competition. *Folia Geobotanica* 41: 377–393.

Palpurina, S., Wagner, V., Chytrý, M., von Wehrden, H., Hájek, M., Horsák, M., Brinkert, A., Hölzel, N., Wesche, K., Kamp, J., Hájková, P., Danihelka, J., Lustyk, P., Merunková, K., Preislerová, Z., Kočí, M., Kubešová, S., Cherosov, M., Ermakov, N., German, D., Gogoleva, P., Lashchinsky, N., Martynenko, V. in press. The relationship between plant species richness and soil pH vanishes with increasing aridity across Eurasian dry grasslands. *Global Ecology and Biogeography*.

Polyakova, M.A., Dembicz, I., Becker, T., Becker, U., Demina, O.N., Ermakov, N., Filibeck, G., Guarino, R., Janišová, M., Jaunatre, R., Kozub, Ł., Steinbauer, M.J., Suzuki, K., Dengler, J. in press. Scale- and taxon-dependent patterns of plant diversity in steppes of Khakassia, South Siberia (Russia). *Biodiversity and Conservation* 25: 2251−2273.

Shmida, A. & Wilson, M.V. 1985. Biological determinants of species diversity. *Journal of Biogeography* 12: 1–20.

Siefert, A., Ravenscroft, C., Althoff, D., Alvarez-Yépiz, J.C., Carter, B.E., Glennon, K.L., Heberling, J.M., Jo, I.S., Pontes, A., (…) & Fridley, J.D. 2012. Scale dependence of vegetation-environment relationships: a meta-analysis of multivariate data. *Journal of Vegetation Science* 23: 942–951.

Soliveres, S., van der Plas, F., Manning, P., Prati, D., Gossner, M.M., Renner, S.C., Alt, F., Arndt, H., Baumgartner, V., (…) & Allan, E. 2016. Biodiversity at multiple trophic levels is needed for ecosystem multifunctionality. *Nature* 536: 456–459.

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

van Kleunen, M., Dawson, W., Essl, F., Pergl, J., Winter, M., Weber, E., Kreft, H., Weigelt, P., Kartesz, J., (…) & Pyšek, P. 2015. Global exchange and accumulation of non-native plants. *Nature* 525: 100−103.

Wagner, V., Chytrý, M., Zelený, D., von Wehrden, H., Brinkert, A., Danihelka, J., Jansen, F., Hölzel, N., Kamp, J., Lustyk, P., Merunková, K., Palpurina, S. , Preislerová, Z. & Wesche, K. in press. Regional differences in soil pH niche among dry gra ssland plants in Eurasia. *Oikos*. DOI: 10.1111/oik.03369.

Wilson, J.B., Peet, R.K., Dengler, J. & Pärtel, M. 2012. Plant species richness: the world records. *Journal of Vegetation Science* 23: 796–802.

Wisz, M.S., Pottier, J., Kissling, W.D., Pellissier, L., Lenoir, J., Damgaard, C.F., Dormann, C.F., Forchhammer, M.C., Grytnes, J.-A., Guisan, A., Heikkinen, R.K., Høye, T.T., Kühn, I., Luoto, M., Maiorano, L., Nilsson, M.-C., Normand, S., Öckinger, E., Schmidt, N.M., Termansen, M., Timmermann, A., Wardle, D.A., Aastrup, P., Svenning, J.-C. 2013. The role of biotic interactions in shaping distributions and realised assemblages of species: implications for species distribution modelling. *Biological Reviews* 88: 15−30.