sPlot open - An environmentally-balanced, open-access, global dataset of vegetation plots

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Abstract

Assessing biodiversity status and trends in plant communities is critical for understanding, quantifying and predicting effects of global change on ecosystems. Vegetation plots record plant species occurrence or abundance (community composition) data – including both absences and presences, allowing analyses not possible with presence-only data. Recently the first global vegetation plot database was compiled ('sPlot'). However, this large dataset is environmentally and spatially unbalanced, and not open-access. We address both issues by (a) resampling the vegetation plots using a novel algorithm; (b) securing permission to openly release data from the holders of 104 specific datasets. We present the largest open-access vegetation plot dataset ever released: 91,205 plots globally, recording abundance of each vascular plant species (total 39,997 taxa). Values for 18 traits are provided per species, and community-weighted mean and variance per plot. Plot-level data include location, date, size, biome, elevation, aspect, vegetation type and naturalness. The dataset can be used to explore plant community diversity patterns globally, as ground truthing data in remote sensing applications or as baselines for biodiversity monitoring.

Background & Summary

Biodiversity is facing a global crisis. As many as 1 million species are currently threatened with extinction, the vast majority due to anthropogenic impacts such as land-use and climate change (1, 2). In addition, the rates of biodiversity homogenization and redistribution are accelerating (3, 4; 5). Biological assemblages are becoming progressively more similar to each other globally, as local and endemic species go extinct and are replaced by more widespread and competitive native or alien species (1; 5). Many terrestrial and marine species are also shifting their geographical distribution as a response to climate change (4), including animals hosting pathogens transmissible to humans (6; 7). This has profound potential impacts on human and ecosystem health (8; 9).

Plant communities are no exception to this biodiversity crisis (10; 11; 5). This is worrisome since terrestrial vegetation accounts for 80% (450 Gt C) of the living biomass on Earth (12). Given the central role of vegetation in ecosystem productivity, stability and functioning (11), assessing biodiversity status and trends in plant communities is paramount for other kingdoms of life and human societies alike.

Monitoring trends in plant biodiversity requires adequate data across a range of spatiotemporal scales (13, 14). Large independent collections of plant occurrence data do exist at the global or continental extent via the Botanical Information and Ecology Network (BIEN) (15), the Global Inventory of Floras and Traits (GIFT) (16) or the Global Biodiversity Information Facility (GBIF) (https://www.gbif.org/). However, these presence-only databases either neglect how individual plant species co-occur and interact locally to form plant communities, or are collected at spatial resolutions which are too coarse to assess biodiversity trends (e.g., one-degree grid cells) at the plant community scale (17).

Yet, there is a long tradition among botanists to record the cover or abundance of each plant species that occurs in a vegetation plot of a given size (i.e. surface area) at a given time (e.g. 18). Compared to presence-only data, vegetation-plot data (termed 'presence-absence' here) present many advantages. First, they contain information on which plant species do, and do not, co-occur in the same locality at a given moment in time (19). This is important for testing hypotheses related to biotic interactions among plant species. Vegetation-plot data also provide crucial information on where and when a species was absent, therefore improving predictions from current species distribution models (20). Being spatially explicit, vegetation plots can be resurveyed through time to assess potential changes in plant species composition relative to a baseline (21; 22, 5). As they normally contain information on the relative cover or abundance of each species, vegetation plots are also more appropriate for detecting biodiversity changes than data representing only the occurrence of individual species (23).

Globally, however, vegetation-plot data are very fragmented, as they typically stem from a myriad of local research and survey projects (24). Consequently, these data often have either high fine-grain spatial resolutions but small spatial extents, or vice versa (25). Furthermore, with their disparate sampling protocols, standards and taxonomic resolutions, aggregating and harmonizing vegetation plot data proves extremely challenging (26). It is not surprising, therefore, that these data are rarely used in global-scale biodiversity research (27; 28; 29).

The sPlot initiative tries to close this data gap. It leverages numerous local-to-regional vegetation-plot datasets to create a harmonized and comprehensive global database of georeferenced terrestrial plant species assemblages (24). Established in 2013, sPlot (version 3) currently contains more than 1.9 million vegetation plots, and is fully integrated with the TRY database (30), from which it derives information on plant functional traits. The sPlot database is increasingly being used to study continental-to-global scale vegetation patterns, such as the relative contribution of regional vs. local factors on the global patterns of fern richness (31), the mechanisms underlying the spread and abundance of native vs. invasive tree species (32), and worldwide trait–environment relationships in plant communities (26).

Here, we provide an open-access data set composed of 91,205 vegetation plots, that represent the entire environmental space covered by the sPlot database, to provide a standardized dataset for ecological research. The environmental stratification of the sampling of these plots maximises the benefits of this large dataset for a wide range of potential uses of the data. The selected vegetation plots stem from 104 databases and span 115 countries (Figure 1). This resampled dataset (sPlot Open - hereafter) is composed of: (1) plot-level information, including metadata and basic vegetation structure descriptors; (2) the vascular plant species composition of each vegetation plot, including species cover or abundance information when available; and (3) community-level functional information derived from the TRY database (30).

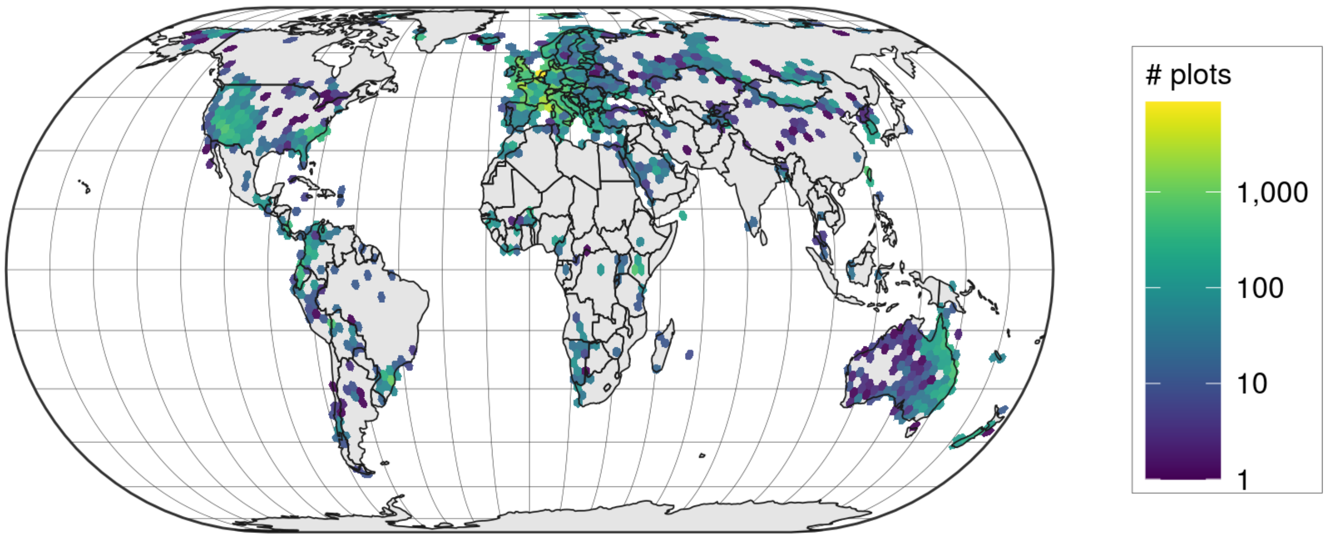

Figure 1: Global map of sPlot Open (n = 91,205) and spatial distribution of vegetation plot density per hexagonal cell with a spatial resolution of approximately 70.000 km². Map projection is Eckert IV.

Methods

Vegetation plot data sources

We started from the sPlot database v2.1 (created October 2016), which contains 1,121,244 vegetation plots and 23,586,216 species records stemming from 110 different vegetation-plot datasets of regional, national or continental extent. Some of the 110 datasets stem from regional or continental initiatives (see 24 for more information). For instance: 48 vegetation-plot datasets derive from the European Vegetation Archive (EVA) (19); three major African datasets derive from the Tropical African Vegetation Archive (TAVA); and multiple vegetation datasets in the USA derive from the VegBank archive (33; 34). Data from other continents (South America, Asia) or countries were contributed as separate standalone datasets. The metadata of each individual vegetation-plot dataset stored in sPlot are managed through the Global Index of Vegetation-Plot Databases GIVD (35), using the GIVD identifier as the unique dataset identifier.

Resampling method

Data in the sPlot database are unevenly distributed across continents and biomes (see 26). Mid-latitude regions in developed countries (mostly Europe, the USA and Australia) are overrepresented, while regions in the tropics and subtropics are underrepresented, which is a typical geographical bias in biodiversity data (e.g., 36; 4). To reduce this imbalance to the extent possible, we performed a stratified resampling approach, using several environmental variables available at global extent as sampling strata. We considered 30 climatic and soil variables. For climate, we complemented the 19 bioclimatic variables from CHELSA (37), as well as two variables reflecting growing-season warmth (growing degree days above 1 °C - GDD1 - and 5 °C - GDD5), which we calculated based on CHELSA bioclimatic variables. In addition, we considered an index of aridity (AR) and a model for Potential Evapotranspiration (PET - 38). For soil, we extracted seven variables from the SOILGRIDS database (39), namely: soil organic carbon content in the fine earth fraction, cation exchange capacity, pH, as well as the fractions of coarse fragments, sand, silt and clay.

We stratified our sampling effort based on the following procedure. First, we ran a global principal component analysis (PCA) of the 30 above-mentioned environmental variables. We considered the full environmental space of all terrestrial habitats on Earth at a spatial resolution of 2.5 arcmin, totaling 8,384,404 terrestrial grid cells, irrespective of whether a grid cell hosted vegetation plots from the sPlot database v2.1 or not. We then subdivided the PCA ordination space based on all terrestrial habitats into a regular 100 × 100 grid, limitedly to the first two principal components (PC1–PC2), which accounted for 47% and 23% of the total variation, respectively. This PC1-PC2 bidimensional space was subsequently used to balance our sampling effort across all PC1-PC2 grid cells for which vegetation plots are available. Before projecting vegetation plots from the sPlot database v2.1 onto this PC1-PC2 environmental space, we removed vegetation plots: from wetlands; from anthropogenic vegetation types; without geographical coordinates; and with a location uncertainty higher than 3 km for those having geographical coordinates. This resulted in a total of 799,400 out of the initial set of 1,121,244 vegetation plots. When projecting the 799,400 vegetation plots in the PC1-PC2 grid, we calculated how many vegetation plots occurred in each PC1-PC2 grid cell. For those grid cells with more than 50 vegetation plots (n = 858), we selected up to 50 vegetation plots using the heterogeneity-constrained random resampling algorithm from Lengyel et al. (2011) [40]. This approach optimizes the selection of a random subset of vegetation plots that encompasses the highest variability in species composition while avoiding peculiar and rare communities, which may represent outliers. We based the quantification of variability in plant species composition among the 50 randomly selected vegetation plots by computing the mean and the variance of the Jaccard's dissimilarity index (41) between all possible pairs of these 50 vegetation plots (n = 1225). More precisely, for a given PC1-PC2 grid cell containing more than 50 vegetation plots, we generated 1,000 random selections of 50 vegetation plots and ranked them according to the mean (ascending order) and variance (descending order) value. Ranks from both sortings were summed for each random selection, and the selection with the lowest summed rank was considered to provide the most balanced/even representation of vegetation types within the focal grid cell. Where a grid cell contained fewer than 50 plots, we retained all of them. In this way, we reduced the imbalance towards over-sampled climate types while ensuring that the resampled dataset represents the entire environmental gradient covered by the sPlot database. We repeated the resampling procedure three times to get three different possibilities of a heterogeneity-constrained selection of 50 vegetation plots per PC1-PC2 grid cell with, initially, more than 50 vegetation plots. Vegetation plots selected during the first iteration were our first choice, while we considered the vegetation plots additionally selected in the second and third iteration as reserves when asking for permission to release the data as open access to each dataset's contributor(s).

Permission to release the data as open access

The resampling procedure resulted in a preliminary potential selection of 98,383 vegetation plots (first choice) and 51,634 vegetation plots flagged as reserves (second or third choice for the subset of PC1-PC2 grid cells with more than 50 vegetation plots available). Since the sPlot database is a consortium of independent datasets whose copyright belongs to the data contributor, we used this preliminary potential selection to ask each dataset's custodian (i.e., either the owner of a dataset or its authorized representative in case of a collective dataset) for permission to release the data of each selected vegetation plot as open access. For 8,070 vegetation plots, permission could not be granted because, for instance, the data are unpublished, confidential or sensitive. For these vegetation plots, we used the reserve pool to randomly select replacements, for which such permission could be granted. We imposed the constraint that each candidate vegetation plot in the reserve pool should belong to the same environmental stratum, i.e., the same PC1-PC2 grid cell, of the confidential vegetation plot. Note that 2,380 PC1-PC2 grid cells (11.7% of total) had one or more confidential vegetation plots (median = 1, mean = 3.4, max = 171) that could not be replaced from the reserve pool.

Trait information

For each vegetation plot for which open access has been granted, we computed the community weighted means for eighteen plant functional traits derived from the TRY database v3.0 (30). These traits were selected among those traits that describe the leaf, wood and seed economics spectra (42; 43), and are known to either affect different key ecosystem processes or respond to macroclimatic drivers, or both (24). The eighteen plant functional traits were: (1) leaf area [mm^2]; (2) stem specific density [$g\ cm^{-3}$]; (3) specific leaf area [$m^2 kg^{-1}$]; (4) leaf carbon concentration [$mg\ g^{-1}$]; (5) leaf nitrogen concentration [$mg\ g^{-1}$]; (6) leaf phosphorus concentration [$mg\ g^{-1}$]; (7) plant height [m]; (8) seed mass [mg]; (9) seed length [mm]; (10) leaf dry matter content [$g\ g^{-1}$]; (11) leaf nitrogen per area [$g\ m^{-2}$]; (12) leaf N:P ratio [$g\ g^{-1}$]; (13) leaf $\delta^{15}N$ [per million]; (14) seed number per reproductive unit; (15) leaf fresh mass [g]; (16) stem conduit density [mm^{-2}]; (17) dispersal unit length [mm]; and (18) conduit element length [μm].

Because missing values were particularly widespread in the species-trait matrix, we employed a gap-filling procedure based on hierarchical Bayesian modeling (R package 'BHPMF', 44; 45). Gap-filling was performed at the level of individual observations. We then transformed to the natural logarithm all gap-filled trait values and averaged each trait by taxon (i.e., at species, or genus level). Additional information on the gap-filling procedure is available in [24].

Community-weighted means (CWM) and variances (CWV) were calculated for every plant functional trait j and every vegetation plot k as follows (46):

$$CWM_{j,k} = \sum_{i}^{n_k} p_{i,k} t_{i,j} \tag{1}$$

$$CWV_{j,k} = \sum_{i}^{n_k} p_{i,k} (t_{i,j} - CWM_{j,k})^2 \tag{2}$$

where n_k is the number of species with trait information in vegetation plot *k*, $p_{i,k}$ is the relative abundance of species *i* in vegetation plot *k* calculated as the species' fraction in cover or abundance of total cover or abundance, and $t_{i,j}$ is the mean value of species *i* for trait *j*.

Data Records

sPlot Open contains 91,205 vegetation plots (also called 'relevés') from 115 countries and all continents except Antarctica (Figure 1). This randomized selection comes from 105 constitutive datasets (Table 1). It only contains the species composition of vascular plants as information on the composition of bryophytes and lichens was discarded since it was only available for a minority of plots (n = 4,963 and n = 3,045, respectively). Information on the size (surface area) of the vegetation survey is available for 61,898 vegetation plots, and ranges between 0.01 and 40,000 m^2 (mean = 270 m^2; median = 78.5 m^2). Similarly, only for a minority of plots (n = 17,757) information on the exact group of plants sampled in the field is available (e.g., complete vegetation, only trees, only trees > 1 m height, and so on). However, as most data were collected using the phytosociological method, we deem safe to assume that, unless otherwise specified, plots contain information on all vascular plants. The average number of vascular plant species per vegetation plot ranges between 1 (i.e. monospecific stands) and 270 species (mean = 17.6; median = 13).

By capping the number of vegetation plots in overrepresented environmental conditions, the resampling procedure described above strongly reduced the bias in the distribution of vegetation plots within the environmental niche space. Yet, due to the lack or scarcity of data from some geographical regions, like the tropics, the spatial distribution of vegetation plots remains unbalanced across geographical regions (Figure 1). This is evident when comparing the number of plots across continents or biomes. Europe is by far the best represented continent, with 53,884 vegetation plots. In contrast, in Africa and South America the remaining plots after data edition and selection were 4,507 and 5,533 vegetation plots, respectively. The representation of biomes is also unbalanced (Figure 2). Despite these imbalances, all the Whittaker biomes are covered by sPlot Open, and our resampling algorithm has resulted in a much more balanced dataset than many other large global datasets that are available, such as GBIF.

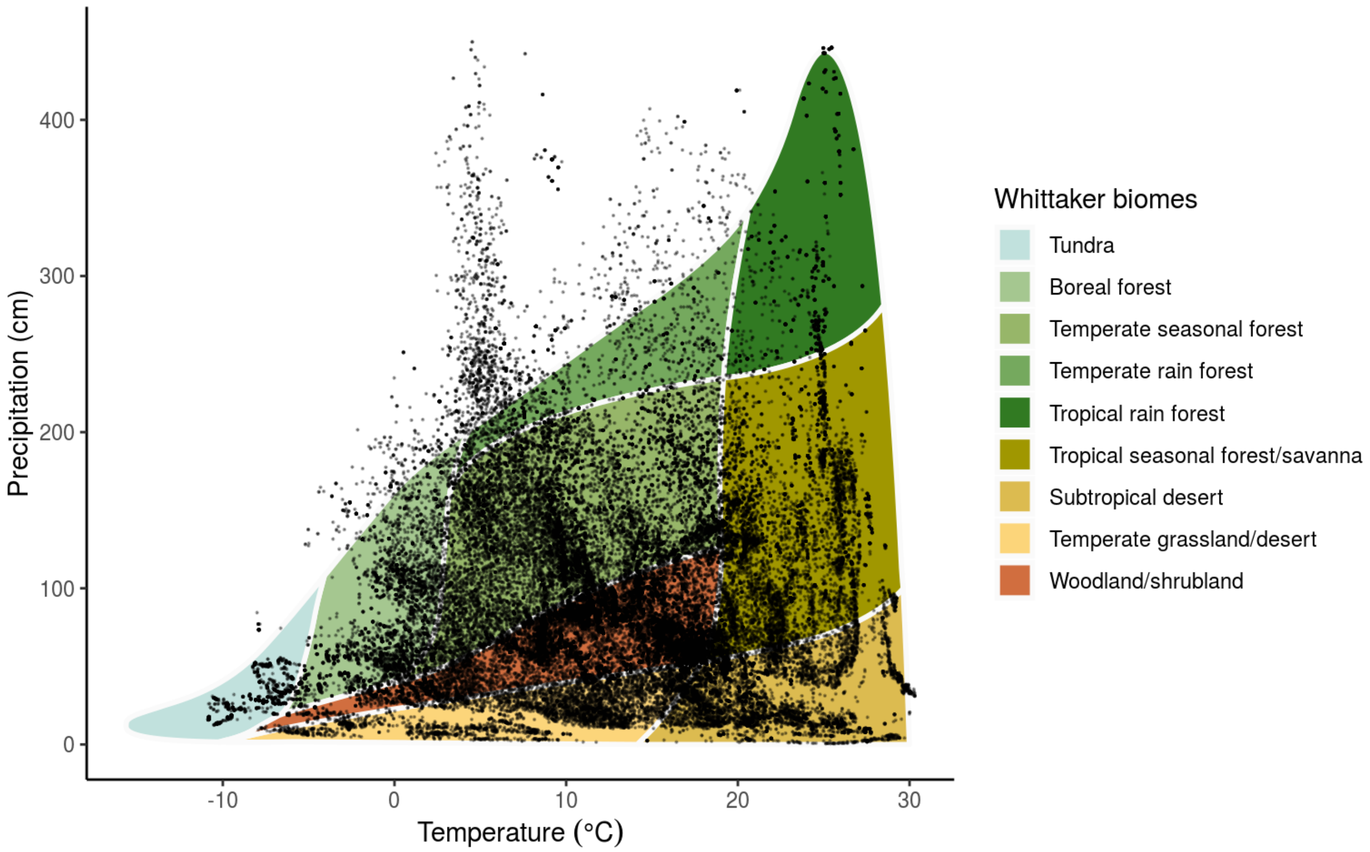

Figure 2: Distribution of all the vegetation plots provided by sPlot Open (n = 91,205) in the bi-dimensional climatic space represented by mean annual temperature and mean annual precipitation superimposed onto Whittaker biomes

(47)

Finally, vegetation plots in sPlot Open belong to forest (n = 25,740) or non forest (n = 58,145) vegetation, with a minor proportion of plots remaining unassigned (n = 7,320). When not directly done by data providers, the assignment of plots to forests and non-forests was based on multiple lines of evidence, including the plot-level information on the cover of the tree layer, as well as traits of species composing a plot, such as growth form and height. In short, a plot record was considered as forest if the cover of the tree layer, or alternatively, the sum of the relative cover of all tree taxa (normalized to 100%), was greater than 25%. It was considered a non-forest record if the sum of relative cover of low-stature, non-tree and non-shrub taxa was greater than 90%. For an extensive explanation of this classification scheme, we refer the reader to Bruelheide et al. (2019) [24]. Even if the proportion of forest vs. non-forest vegetation plots is relatively well-balanced, the geographical distribution of vegetation plots belonging to different vegetation types is likely not balanced in the geographical space, as it depends on the idiosyncrasies of the constitutive datasets composing the sPlot database. For instance, the data from New Zealand only include plots collected in non-forest ecosystems, while data from Chile only refer to forests. We urge potential users to carefully read the description of each individual dataset in GIVD, or to contact the custodians of each dataset before using sPlot Open.

Database Organization

sPlot Open is organized into three main matrices, relationally linked through the key column *'PlotObservationID'*.

The **'header'** matrix contains plot-level information for the 91,205 vegetation plots provided in sPlot Open, including: metadata (e.g., plot ID, ownership, sampling date, geographical location, positional accuracy); sampling design information (e.g., the total surface area used during the vegetation survey); and a plot-level description of vegetation structure (e.g., vegetation type, percentage cover of each vegetation layer) and vegetation type. Plots in Europe are also classified according to the EUNIS habitat classification (column *'ESY'*), based on the habitat classification expert system described in Chytrý et al. (2020) (48). For each vegetation plot, we further provide information on the dataset it originates from, based on the IDs used in GIVD. A brief description of all the 43 variables in the header matrix is provided in Table 2.

The **'DT'** matrix contains data on the species composition of each plot. It is structured in a long format and contains 1,608,610 records from 39,997 vascular plant taxa, mostly resolved at the species level. For each record, we report both the taxon name as originally contributed by the data custodian (column *'Original_species'*), and the taxon name after taxonomic standardization (column *'Species'*). For each record, we report the species cover/abundance values. These follow different standards across the datasets constituting the sPlot database. We, therefore, provide both the cover/abundance value as reported in the original data (column *'Original_abundance'*), together with the abundance scale that was originally used (column *'Abundance_scale'*). This can take seven values: 'CoverPerc' = percentage cover, 'pa' = presence-absence, 'x_BA' = basal area (m^2/ha, only for woody species), 'x_IC' = individual count, i.e., number of individuals in plot, 'x_SC' = stem count, i.e., number of stems in plot, 'x_IV' = importance value index, 'x_PF' = presence frequency. The great majority of entries, however, use the percentage cover scale (n= 1,397,109). Finally, for each entry, we calculated a *'Relative_cover'*, i.e., the cover/abundance of a given taxon divided by the total cover/abundance of all taxa in that vegetation plot.

The **'CWM_CWV'** matrix contains the community-weighted means and variances calculated for each of the 18 functional traits mentioned above. It also contains three additional columns. The column *'Species_richness'* returns the number of species recorded in each plot. The columns *'Trait_coverage_cover'* and *'Trait_coverage_pa'* return, respectively, the proportion of total cover and species in a plot for which functional trait information was available. Functional trait information was available for 20,932 species. The average proportion of species in each plot for which we have functional trait information is 0.88 (median = 1). For 47,177 plots, the coverage is complete, while for only one plot do we have no functional trait information for any of the species occurring in it. When considering relative cover, the average trait coverage is 0.89. As many as 68,234 and 74,388 plots have functional trait information for more than 80% of the species or 80% of relative cover, respectively.

sPlot Open contains two additional objects. The **'metadata'** matrix contains plot-level metadata, which provide information on the origin of each individual vegetation plot. This object contains 15 columns, with information on the dataset of origin (column *'GIVD_ID'* - 35), author or surveyor names (columns *'Releve_author'* and *'Releve_coauthor'*), bibliographic references both at the dataset (column *'DB_BIBTEXKEY'*) and plot level (*'Plot_Biblioreference'* and *'BIBTEXKEY'*), when available. Similarly, the column *'Project_name'* provides information on the project in which a vegetation plot was collected. When available, we also provide information on the numbering of the plots in the publication where they originally appeared (columns *'Nr_table_in_publ'*, *'Nr_releve_in_table'*), or in the dataset where they were initially stored (*'Original_nr_in_database'*). In the case of nested plots (n = 1,786), we also provide the original plot and subplot IDs (columns: *'Original_plotID'*, *'Original_subplotID'*). The last two columns report plot-level *'Remarks'*, and the unique identifier produced by Turboveg when the vegetation plot was first stored (*'GUID'*).

Finally, the object **'references'**, contains all the bibliographic references formatted according to a BibTex standard. Each reference is tagged with a key corresponding to the fields *'DB_BIBTEXKEY'* and *'BIBTEXKEY'* in the metadata. We further provide an R function (*'sPlotOpen_citation'*) to create reference lists, based on a selection of plots and/or datasets.

Except for the 'reference' file (format .bib), all objects/matrices are provided in tab-delimited .txt files. All objects, including the 'sPlotOpen_citation' function, are also compiled inside an .RData object.

Technical Validation

The original sPlot database has a nested structure and is composed of several individual datasets, each validated and maintained by its respective dataset custodian. In many cases, individual datasets are also collections whose vegetation plots were provided by their respective owners (the person who performed the actual vegetation survey) or by someone who digitized the original data from the scientific or grey literature. We obviously have no direct control over the individual vegetation plots that we provide here in sPlot Open. Yet, all of these vegetation plots stem from trained professional botanists, or published scientific work, and are accompanied by detailed information on the sampling protocols used, thus ensuring data quality and reliability.

Before integration into the sPlot database, each dataset was further checked for consistency and, if it had a different format, was converted to a Turboveg 2 database (49). During this conversion, we checked that all datasets contained the required metadata information, and cross-checked that each plot was located within the geographic scopes of its respective dataset. Finally, we harmonized all the taxonomic names from all datasets, based on the sPlot's taxonomic backbone (50). This backbone matched all the taxonomic names (without nomenclatural authors) from all datasets in sPlot 2.1 and TRY v3.0 (30) to their resolved version based on the Taxonomic Name Resolution Service web application (TNRS version 4.0; 51; iPlant Collaborative, 2015). This allowed us to (1) harmonize all datasets to a common nomenclature, and (2) link the sPlot database to the TRY database (30). All taxa originally denoted at taxonomic ranks lower than species were aggregated at species level. Additional detail on the taxonomic resolution is reported in Bruelheide et al. (2019) [24], while a description of the workflow, including R-code, is available in Purschke (2017) [50].

Usage Notes

The sPlot Open database can be downloaded from https://www.idiv.de (link to PlantHub). Users are urged to cite the original sources when using sPlot Open in addition to the present paper, particularly when using data contained in BioTIME (52). For two datasets (AF-00-009, AF-CD-001), the identification of taxa at species level is still in progress. Being most of the datasets under continuous development, sPlot Open users are encouraged to get in touch with the custodian(s) of the data they are planning to use (custodian names are reported in https://www.idiv.de/sPlot).

The data included in the present paper represent the subset of sPlot for which we were able to secure permission for making these data open. The additional data in sPlot are available under sPlot's Governance and Data Property Rules (www.idiv.de/sPlot).

Code Availability

The R code used to produce sPlot Open from the sPlot 2.1 database is contained in the *sPlotOpen_code* GitHub repository: (https://github.com/fmsabatini/sPlotOpen_Code/). This manuscript was produced using the Manubot workflow (53). The code for reproducing this manuscript is stored in the *sPlotOpen_manuscript* GitHub repository: (https://github.com/fmsabatini/sPlotOpen_Manuscript).

Acknowledgements

We are grateful to thousands of vegetation scientists who sampled vegetation plots in the field or digitized them into regional, national or international databases. We also appreciate the support of the German Research Foundation for funding sPlot as one of the iDiv (DFG FZT 118, 202548816) research platforms, and the organization of three workshops through the sDiv calls. We acknowledge this support with naming the database “sPlot”, where the “s” refers to the sDiv synthesis workshops.

The study has been supported by the TRY initiative on plant traits (http://www.try-db.org). The TRY initiative and database is hosted, developed and maintained by J. Kattge and G. Bönisch (Max Planck Institute for Biogeochemistry, Jena, Germany). TRY is currently supported by DIVERSITAS/Future Earth and the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig. Jens Kattge acknowledges support by the Max Planck Institute for Biogeochemistry (Jena, Germany), Future Earth, the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig and the EU H2020 project BACI, Grant No 640176.

Isabelle Aubin was funded through Natural Sciences and Engineering Research Council of Canada and Ontario Ministry of Natural Resources and Forestry. Yves Bergeron was funded through Natural Sciences and Engineering Research Council of Canada. Idoia Biurrun was funded by the Basque Government (IT936-16). Anne Bjorkman thank the Herschel Island-Qikiqtaruk Territorial Park management, Catherine Kennedy, Dorothy Cooley, Jill F. Johnstone, Cameron Eckert and Richard Gordon for establishing the ecological monitoring programme. Funding was provided by Herschel Island-Qikiqtaruk Territorial Park. Luis Cayuela was supported by project BIOCON08_044 funded by Fundación BBVA. Milan Chytrý, Flavia Landucci, Corrado Marcenò and Tomáš Peterka were supported by the Czech Science Foundation (project no. 19-28491X). Jiri Dolezal would like to acknowledge the financial support from MSMT-INTER-EXCELLENCE project (LTAUSA18007). Brian Enquist thanks the following individuals and institutions for contributing data to sPlot via the SALVIAS database: Mauricio Bonifacino, Saara DeWalt, Timothy Killeen, Susan Letcher, Nigel Pitman, Cam Webb, The Missouri Botanical Garden, RAINFOR and the Amazon Forest Inventory Network. Alvaro G. Gutiérrez acknowledges FONDECYT 11150835, Project FORECOFUN-SSA PIEF-GA-2010–274798), CONICYT-PAI (82130046). Mohamed Z. Hatim thanks Kamal Shaltout and Joop Schaminée for supervision of the MSc thesis, and Joop Schaminée for support and funding from the Prince Bernard Culture Fund Prize for Nature Conservation. Jürgen Homeier received funding from BMBF (Federal Ministry of Education and Science of Germany) and the German Research Foundation (DFG Ho3296-2, DFG Ho3296-4). Borja Jiménez-Alfaro was funded by the Spanish Research Agency through grant AEI/10.13039/501100011033 Dirk N. Karger recieved funding from: The WSL internal grant exCHELSA and ClimEx, the Joint Biodiversa COFUND project ‘FeedBaCks’ and ‘Futureweb’, the Swiss Data Science Projects: SPEEDMIND, and COMECO, and the Swiss National Science Foundation (20BD21_184131). Attila Lengyel was supported by the National Research, Development and Innovation Office, Hungary (PD-123997). Tatiana Lysenko was funded by Russian Foundation for Basic Research (grant No. 16-04-00747a). Jérôme Munzinger was supported by the French National Research Agency (ANR) with grants INC (ANR-07-BDIV-0008), BIONEOCAL (ANR-07-BDIV-0006) & ULTRABIO (ANR-07-BDIV-0010), by National Geographic Society (Grant 7579-04), and with fundings and authorizations of North and South Provinces of New Caledonia. Arkadiusz Nowak received support from the National Science Centre, Poland, grant no. 2017/25/B/NZ8/00572. Gerhard E. Overbeck acknowledges support from Brazil’s National Council of Scientific and Technological Development (CNPq, grant 310022/2015-0). Robert Peet acknowledges the support from the National Center for Ecological Analysis and Synthesis, the North Carolina Ecosystem Enhancement Program, the U.S. Forest Service, and the U.S. National Science Foundation (DBI-9905838, DBI-0213794). Josep Peñuelas would like to acknowledge the financial support from the European Research Council Synergy grant ERC-SyG-2013-610028 IMBALANCE-P Oliver Phillips was funded by an ERC Advanced Grant (291585, “T-FORCES”) and a Royal Society-Wolfson Research Merit Award. Valério D. Pillar has been supported by the Brazil’s National Council of Scientific and Technological Development (CNPq, grant 307689/2014-0). Solvita Rūsiņa was supported by the University of Latvia grant AAP2016/B041//Zd2016/AZ03 within the “Climate change and sustainable use of natural resources”. Franziska Schrodt was supported by a University of Minnesota Institute on the Environment Discovery Grant, a German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig grant (50170649_#7) and a University of Nottingham Anne McLaren

Fellowship. Jens Christian Svenning considers this work a contribution to his VILLUM Investigator project “Biodiversity Dynamics in a Changing World” funded by VILLUM FONDEN (grant 16549). Kim André Vanselow would like to thank W. Bernhard Dickoré for the help in the identification of plant species and acknowledge the financial support from the Volkswagen Foundation (AZ I/81 976) and the German Research Foundation (DFG VA 749/1-1, DFG VA 749/4-1). Evan Weiher was funded by NSF DEB-0415383, UWEC-ORSP, and UWEC-BCDT. Work by Karsten Wesche was supported by the German Research Foundation (DFG WE 2601/3-1,3-2, 4-1,4-2) and by the German Ministry for Science and Education (BMBF, CAME 03G0808A) Susan Wiser was funded by the NZ Ministry for Business, Innovation and Employment’s Strategic Science Investment Fund.

This paper is dedicated to the memory of Dr. Ching-Feng (Woody) Li.

Author contributions

FMS wrote the first draft of the manuscript, with considerable input from JL and HB. JL and TH wrote the resampling algorithm. FMS set up the GitHub projects, curated the database, and produced the graphs. He also coordinated the sPlot consortium. SMH wrote the Turboveg v3 software, which holds the sPlot database. JK provided the trait data from TRY and FS performed the trait data gap filling. HB secured the funding for sPlot as a strategic project of iDiv. All other authors contributed data and/or helped set up the database and/or helped develop the resampling algorithm. All authors contributed to revising the manuscript.

Competing interests

The authors declare no competing interests.

References

1. **Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services**
   IPBES
   IPBES secretariat (2019)
   ISBN: 978-3-947851-13-3

2. **Living planet report**
   WWF
   (2018)
   ISBN: 9782940529902

3. **Accelerating homogenization of the global plant–frugivore meta-network**
   Evan C. Fricke, Jens-Christian Svenning
   Nature (2020-09-02) https://doi.org/ghgs3g
   DOI: 10.1038/s41586-020-2640-y · PMID: 32879498

4. **Species better track climate warming in the oceans than on land**
   Jonathan Lenoir, Romain Bertrand, Lise Comte, Luana Bourgeaud, Tarek Hattab, Jérôme Murienne, Gaël Grenouillet
   Nature Ecology & Evolution (2020-05-25) https://doi.org/ggx3np
   DOI: 10.1038/s41559-020-1198-2 · PMID: 32451428

5. **Replacements of small- by large-ranged species scale up to diversity loss in Europe's temperate forest biome**
   Ingmar R. Staude, Donald M. Waller, Markus Bernhardt-Römermann, Anne D. Bjorkman, Jörg Brunet, Pieter De Frenne, Radim Hédl, Ute Jandt, Jonathan Lenoir, František Máliš, … Lander Baeten
   Nature Ecology & Evolution (2020-04-13) https://doi.org/ggrs73
   DOI: 10.1038/s41559-020-1176-8 · PMID: 32284580

6. **Global trends in emerging infectious diseases**
   Kate E. Jones, Nikkita G. Patel, Marc A. Levy, Adam Storeygard, Deborah Balk, John L. Gittleman, Peter Daszak
   Nature (2008-02) https://doi.org/cbxh9h
   DOI: 10.1038/nature06536 · PMID: 18288193 · PMCID: PMC5960580

7. **Altitudinal Changes in Malaria Incidence in Highlands of Ethiopia and Colombia**
   A. S. Siraj, M. Santos-Vega, M. J. Bouma, D. Yadeta, D. R. Carrascal, M. Pascual
   Science (2014-03-06) https://doi.org/f5vb47
   DOI: 10.1126/science.1244325 · PMID: 24604201

8. **Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being**
   Gretta T. Pecl, Miguel B. Araújo, Johann D. Bell, Julia Blanchard, Timothy C. Bonebrake, I-Ching Chen, Timothy D. Clark, Robert K. Colwell, Finn Danielsen, Birgitta Evengård, … Stephen E. Williams
   Science (2017-03-31) https://doi.org/f9xmpm
   DOI: 10.1126/science.aai9214 · PMID: 28360268

9. **Managing consequences of climate-driven species redistribution requires integration of ecology, conservation and social science**
Timothy C. Bonebrake, Christopher J. Brown, Johann D. Bell, Julia L. Blanchard, Alienor Chauvenet, Curtis Champion, I-Ching Chen, Timothy D. Clark, Robert K. Colwell, Finn Danielsen, … Gretta T. Pecl
Biological Reviews (2018-02) https://doi.org/gc2dvc
DOI: 10.1111/brv.12344 · PMID: 28568902

10. **A Significant Upward Shift in Plant Species Optimum Elevation During the 20th Century**
J. Lenoir, J. C. Gegout, P. A. Marquet, P. de Ruffray, H. Brisse
Science (2008-06-27) https://doi.org/bnhhj8
DOI: 10.1126/science.1156831 · PMID: 18583610

11. **The functional role of producer diversity in ecosystems**
Bradley J. Cardinale, Kristin L. Matulich, David U. Hooper, Jarrett E. Byrnes, Emmett Duffy, Lars Gamfeldt, Patricia Balvanera, Mary I. O'Connor, Andrew Gonzalez
American Journal of Botany (2011-03) https://doi.org/fnh8qs
DOI: 10.3732/ajb.1000364 · PMID: 21613148

12. **The biomass distribution on Earth**
Yinon M. Bar-On, Rob Phillips, Ron Milo
Proceedings of the National Academy of Sciences (2018-06-19) https://doi.org/cp29
DOI: 10.1073/pnas.1711842115 · PMID: 29784790 · PMCID: PMC6016768

13. **Effective Biodiversity Monitoring Needs a Culture of Integration**
Hjalmar S. Kühl, Diana E. Bowler, Lukas Bösch, Helge Bruelheide, Jens Dauber, David. Eichenberg, Nico Eisenhauer, Néstor Fernández, Carlos A. Guerra, Klaus Henle, … Aletta Bonn
One Earth (2020-10) https://doi.org/ghgk4w
DOI: 10.1016/j.oneear.2020.09.010

14. **What we need to know to prevent a mass extinction of plant species**
Stuart L. Pimm
PLANTS, PEOPLE, PLANET (2020-10-28) https://doi.org/ghhwnp
DOI: 10.1002/ppp3.10160

15. **Cyberinfrastructure for an integrated botanical information network to investigate the ecological impacts of global climate change on plant biodiversity**
Brian J Enquist, Rick Condit, Robert K Peet, Mark Schildhauer, Barbara M. Thiers
PeerJ (2018-01-13) https://doi.org/ghfnsx
DOI: 10.7287/peerj.preprints.2615v2

16. **GIFT – A Global Inventory of Floras and Traits for macroecology and biogeography**
Patrick Weigelt, Christian König, Holger Kreft
Journal of Biogeography (2019-06-09) https://doi.org/gf38t6
DOI: 10.1111/jbi.13623

17. **Distorted Views of Biodiversity: Spatial and Temporal Bias in Species Occurrence Data**
Elizabeth H. Boakes, Philip J. K. McGowan, Richard A. Fuller, Ding Chang-qing, Natalie E. Clark, Kim O'Connor, Georgina M. Mace
PLoS Biology (2010-06-01) https://doi.org/brfdq6
DOI: 10.1371/journal.pbio.1000385 · PMID: 20532234 · PMCID: PMC2879389

18. **Versuch einer Übersicht über die Wiesentypen der Schweiz**
F. G. Stebler, C. Schröter

Landwirt. Jahrb. Schweiz (1893)

19. **European Vegetation Archive (EVA): an integrated database of European vegetation plots**
Milan Chytrý, Stephan M. Hennekens, Borja Jiménez-Alfaro, Ilona Knollová, Jürgen Dengler, Florian Jansen, Flavia Landucci, Joop H. J. Schaminée, Svetlana Aćić, Emiliano Agrillo, … Sergey Yamalov
Applied Vegetation Science (2016-01) https://doi.org/bc7k
DOI: 10.1111/avsc.12191

20. **Sample selection bias and presence-only distribution models: implications for background and pseudo-absence data**
Steven J. Phillips, Miroslav Dudík, Jane Elith, Catherine H. Graham, Anthony Lehmann, John Leathwick, Simon Ferrier
Ecological Applications (2009-01) https://doi.org/dx4s78
DOI: 10.1890/07-2153.1 · PMID: 19323182

21. **Global environmental change effects on plant community composition trajectories depend upon management legacies**
Michael P. Perring, Markus Bernhardt-Römermann, Lander Baeten, Gabriele Midolo, Haben Blondeel, Leen Depauw, Dries Landuyt, Sybryn L. Maes, Emiel De Lombaerde, Maria Mercedes Carón, … Kris Verheyen
Global Change Biology (2018-04) https://doi.org/gc6mjp
DOI: 10.1111/gcb.14030 · PMID: 29271579

22. **Accelerated increase in plant species richness on mountain summits is linked to warming**
Manuel J. Steinbauer, John-Arvid Grytnes, Gerald Jurasinski, Aino Kulonen, Jonathan Lenoir, Harald Pauli, Christian Rixen, Manuela Winkler, Manfred Bardy-Durchhalter, Elena Barni, … Sonja Wipf
Nature (2018-04-04) https://doi.org/gdfwk3
DOI: 10.1038/s41586-018-0005-6 · PMID: 29618821

23. **Exploring large vegetation databases to detect temporal trends in species occurrences**
Ute Jandt, Henrik von Wehrden, Helge Bruelheide
Journal of Vegetation Science (2011-12) https://doi.org/d8b4jv
DOI: 10.1111/j.1654-1103.2011.01318.x

24. **sPlot – A new tool for global vegetation analyses**
Helge Bruelheide, Jürgen Dengler, Borja Jiménez-Alfaro, Oliver Purschke, Stephan M. Hennekens, Milan Chytrý, Valério D. Pillar, Florian Jansen, Jens Kattge, Brody Sandel, … Andrei Zverev
Journal of Vegetation Science (2019-04-08) https://doi.org/gfvhkm
DOI: 10.1111/jvs.12710

25. **Biodiversity data integration—the significance of data resolution and domain**
Christian König, Patrick Weigelt, Julian Schrader, Amanda Taylor, Jens Kattge, Holger Kreft
PLOS Biology (2019-03-18) https://doi.org/c3xz
DOI: 10.1371/journal.pbio.3000183 · PMID: 30883539 · PMCID: PMC6445469

26. **Global trait–environment relationships of plant communities**
Helge Bruelheide, Jürgen Dengler, Oliver Purschke, Jonathan Lenoir, Borja Jiménez-Alfaro, Stephan M. Hennekens, Zoltán Botta-Dukát, Milan Chytrý, Richard Field, Florian Jansen, … Ute Jandt
Nature Ecology & Evolution (2018-11-19) https://doi.org/gfj595
DOI: 10.1038/s41559-018-0699-8 · PMID: 30455437

27. **Big data for forecasting the impacts of global change on plant communities**
Janet Franklin, Josep M. Serra-Diaz, Alexandra D. Syphard, Helen M. Regan

Global Ecology and Biogeography (2017-01) https://doi.org/f9hdp3
DOI: 10.1111/geb.12501

28. **Achievements and challenges in the integration, reuse and synthesis of vegetation plot data**
Susan K. Wiser
Journal of Vegetation Science (2016-09) https://doi.org/ghfnr5
DOI: 10.1111/jvs.12419

29. **Managing data locally to answer questions globally: The role of collaborative science in ecology**
Isabelle Aubin, Françoise Cardou, Laura Boisvert-Marsh, Eric Garnier, Manuella Strukelj, Alison D. Munson
Journal of Vegetation Science (2020-04-03) https://doi.org/ggtgsm
DOI: 10.1111/jvs.12864

30. **TRY plant trait database – enhanced coverage and open access**
Jens Kattge, Gerhard Bönisch, Sandra Díaz, Sandra Lavorel, Iain Colin Prentice, Paul Leadley, Susanne Tautenhahn, Gijsbert D. A. Werner, Tuomas Aakala, Mehdi Abedi, … Christian Wirth
Global Change Biology (2020) https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.14904
DOI: https://doi.org/10.1111/gcb.14904

31. **Global fern and lycophyte richness explained: How regional and local factors shape plot richness**
Anna Weigand, Stefan Abrahamczyk, Isabelle Aubin, Claudia Bita-Nicolae, Helge Bruelheide, Cesar I. Carvajal-Hernández, Daniele Cicuzza, Lucas Erickson Nascimento da Costa, János Csiky, Jürgen Dengler, … Michael Kessler
Journal of Biogeography (2019-12-30) https://doi.org/ggf4gr
DOI: 10.1111/jbi.13782

32. **Similar factors underlie tree abundance in forests in native and alien ranges**
Masha T. Sande, Helge Bruelheide, Wayne Dawson, Jürgen Dengler, Franz Essl, Richard Field, Sylvia Haider, Mark Kleunen, Holger Kreft, Joern Pagel, … Tiffany M. Knight
Global Ecology and Biogeography (2019-12) https://doi.org/ggftj7
DOI: 10.1111/geb.13027 · PMID: 32063745 · PMCID: PMC7006795

33. **Vegetation-plot database of the Carolina Vegetation Survey**
Robert K. Peet, Michael T. Lee, M. Forbes Boyle, Thomas R. Wentworth, Michael P. Schafale, Alan S. Weakley
Vegetation databases for the 21st century (2012) https://doi.org/10.7809/b-e.00081

34. **VegBank – a permanent, open-access archive for vegetation-plot data**
Robert K. Peet, M. T. Lee, M. D. Jennings, D. Faber-Langendoen
Vegetation databases for the 21st century (2012) https://doi.org/10.7809/b-e.00080

35. **The Global Index of Vegetation-Plot Databases (GIVD): a new resource for vegetation science**
Jürgen Dengler, Florian Jansen, Falko Glöckler, Robert K. Peet, Miquel De Cáceres, Milan Chytrý, Jörg Ewald, Jens Oldeland, Gabriela Lopez-Gonzalez, Manfred Finckh, … Nick Spencer
Journal of Vegetation Science (2011-08) https://doi.org/ctx2s7
DOI: 10.1111/j.1654-1103.2011.01265.x

36. **Climate-related range shifts - a global multidimensional synthesis and new research directions**

J. Lenoir, J.-C. Svenning
Ecography (2015-01) https://doi.org/f6xz9h
DOI: 10.1111/ecog.00967

37. **Climatologies at high resolution for the earth's land surface areas**
Dirk Nikolaus Karger, Olaf Conrad, Jürgen Böhner, Tobias Kawohl, Holger Kreft, Rodrigo Wilber Soria-Auza, Niklaus E. Zimmermann, H. Peter Linder, Michael Kessler
Scientific Data (2017-09-05) https://doi.org/gbvksk
DOI: 10.1038/sdata.2017.122 · PMID: 28872642 · PMCID: PMC5584396

38. **Global High-Resolution Soil-Water Balance**
Antonio Trabucco, Robert J. Zomer
figshare (2019) https://figshare.com/articles/Global_High-Resolution_Soil-Water_Balance/7707605/3
DOI: 10.6084/m9.figshare.7707605.v3

39. **SoilGrids250m: Global gridded soil information based on machine learning**
Tomislav Hengl, Jorge Mendes de Jesus, Gerard B. M. Heuvelink, Maria Ruiperez Gonzalez, Milan Kilibarda, Aleksandar Blagotić, Wei Shangguan, Marvin N. Wright, Xiaoyuan Geng, Bernhard Bauer-Marschallinger, … Bas Kempen
PLOS ONE (2017-02-16) https://doi.org/f9qc5p
DOI: 10.1371/journal.pone.0169748 · PMID: 28207752 · PMCID: PMC5313206

40. **Heterogeneity-constrained random resampling of phytosociological databases**
Attila Lengyel, Milan Chytrý, Lubomír Tichý
Journal of Vegetation Science (2011-02) https://doi.org/dvjzbz
DOI: 10.1111/j.1654-1103.2010.01225.x

41. **THE DISTRIBUTION OF THE FLORA IN THE ALPINE ZONE.1**
Paul Jaccard
New Phytologist (1912-02) https://doi.org/fvhsjd
DOI: 10.1111/j.1469-8137.1912.tb05611.x

42. **A leaf-height-seed (LHS) plant ecology strategy scheme**
Mark Westoby
Plant and Soil (1998-02-01) https://doi.org/10.1023/A:1004327224729
DOI: 10.1023/a:1004327224729

43. **The world-wide "fast-slow" plant economics spectrum: a traits manifesto**
Peter B. Reich
Journal of Ecology (2014-03) https://doi.org/gfc4z9
DOI: 10.1111/1365-2745.12211

44. **Uncertainty Quantified Matrix Completion Using Bayesian Hierarchical Matrix Factorization**
Farideh Fazayeli, Arindam Banerjee, Jens Kattge, Franziska Schrodt, Peter B. Reich
Institute of Electrical and Electronics Engineers (IEEE) (2014-12) https://doi.org/ghfnw3
DOI: 10.1109/icmla.2014.56

45. **BHPMF - a hierarchical Bayesian approach to gap-filling and trait prediction for macroecology and functional biogeography**
Franziska Schrodt, Jens Kattge, Hanhuai Shan, Farideh Fazayeli, Julia Joswig, Arindam Banerjee, Markus Reichstein, Gerhard Bönisch, Sandra Díaz, John Dickie, … Peter B. Reich

Global Ecology and Biogeography (2015-12) https://doi.org/f76qw8
DOI: 10.1111/geb.12335

46. **Scaling from Traits to Ecosystems**
Brian J. Enquist, Jon Norberg, Stephen P. Bonser, Cyrille Violle, Colleen T. Webb, Amanda Henderson, Lindsey L. Sloat, Van M. Savage
Advances in Ecological Research (2015) https://doi.org/ghfnsw
DOI: 10.1016/bs.aecr.2015.02.001

47. **Communities and Ecosystems**
R. H. Whittaker
Macmillan Publishing Co. Inc. (1975)

48. **EUNIS Habitat Classification: Expert system, characteristic species combinations and distribution maps of European habitats**
Milan Chytrý, Lubomír Tichý, Stephan M. Hennekens, Ilona Knollová, John A. M. Janssen, John S. Rodwell, Tomáš Peterka, Corrado Marcenò, Flavia Landucci, Jiří Danihelka, … Joop H. J. Schaminée
Applied Vegetation Science (2020-08-16) https://doi.org/ghf4dn
DOI: 10.1111/avsc.12519

49. **TURBOVEG, a comprehensive data base management system for vegetation data**
Stephan M. Hennekens, Joop H. J. Schaminée
Journal of Vegetation Science (2001-02-24) https://doi.org/cgmn6m
DOI: 10.2307/3237010

50. **Oliverpurschke/Taxonomic_Backbone: First Release Of The Workflow To Generate The Taxonomic Backbone For Splot V.2.1 And Try V.3.0**
Oliver Purschke
Zenodo (2017-08-18) https://doi.org/ghf4ph
DOI: 10.5281/zenodo.845445

51. **The taxonomic name resolution service: an online tool for automated standardization of plant names**
Brad Boyle, Nicole Hopkins, Zhenyuan Lu, Juan Antonio Raygoza Garay, Dmitry Mozzherin, Tony Rees, Naim Matasci, Martha L Narro, William H Piel, Sheldon J Mckay, … Brian J Enquist
BMC Bioinformatics (2013-01-16) https://doi.org/gb8vxz
DOI: 10.1186/1471-2105-14-16 · PMID: 23324024 · PMCID: PMC3554605

52. **BioTIME: A database of biodiversity time series for the Anthropocene**
Maria Dornelas, Laura H. Antão, Faye Moyes, Amanda E. Bates, Anne E. Magurran, Dušan Adam, Asem A. Akhmetzhanova, Ward Appeltans, José Manuel Arcos, Haley Arnold, … Michael L. Zettler
Global Ecology and Biogeography (2018)
https://onlinelibrary.wiley.com/doi/abs/10.1111/geb.12729
DOI: https://doi.org/10.1111/geb.12729

53. **Open collaborative writing with Manubot**
Daniel S. Himmelstein, Vincent Rubinetti, David R. Slochower, Dongbo Hu, Venkat S. Malladi, Casey S. Greene, Anthony Gitter
PLOS Computational Biology (2019-06-24) https://doi.org/c7np
DOI: 10.1371/journal.pcbi.1007128 · PMID: 31233491 · PMCID: PMC6611653

54. **Database Dry Grasslands in the Nordic and Baltic Region**
Jürgen Dengler, Solvita Rūsiņa

Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcv
DOI: 10.7809/b-e.00114

55. **Vegetation-Plot Database of the University of the Basque Country (BIOVEG)**
Idoia Biurrun, Itziar García-Mijangos, Juan Campos, Mercedes Herrera, Javier Loidi
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgt9d
DOI: 10.7809/b-e.00121

56. **Balkan Dry Grasslands Database**
Kiril Vassilev, Zora Dajiś, Renata Cušterevska, Erwin Bergmeier, Iva Apostolova
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcw
DOI: 10.7809/b-e.00123

57. **The Mediterranean *Ammophiletea* Database: a comprehensive dataset of coastal dune vegetation**
Corrado Marcenò, Borja Jiménez-Alfaro
Phytocoenologia (2016) https://doi.org/ghgt83
DOI: 10.1127/phyto/2016/0133

58. **Local temperatures inferred from plant communities suggest strong spatial buffering of climate warming across Northern Europe**
Jonathan Lenoir, Bente Jessen Graae, Per Arild Aarrestad, Inger Greve Alsos, W. Scott Armbruster, Gunnar Austrheim, Claes Bergendorff, H. John B. Birks, Kari Anne Bråthen, Jörg Brunet, … Jens-Christian Svenning
Global Change Biology (2013-05) https://doi.org/f24bdd
DOI: 10.1111/gcb.12129 · PMID: 23504984

59. **Balkan Vegetation Database: historical background, current status and future perspectives**
Kiril Vassilev, Hristo Pedashenko, Alexandra Alexandrova, Alexandar Tashev, Anna Ganeva, Anna Gavrilova, Asya Gradevska, Assen Assenov, Antonina Vitkova, Borislav Grigorov, … Vladimir Vulchev
Phytocoenologia (2016-06-01) https://doi.org/f8sjft
DOI: 10.1127/phyto/2016/0109

60. **WetVegEurope: a database of aquatic and wetland vegetation of Europe**
Flavia Landucci, Marcela Řezníčková, Kateřina Šumberová, Milan Chytrý, Liene Aunina, Claudia Biţă-Nicolae, Alexander Bobrov, Lyubov Borsukevych, Henry Brisse, Andraž Čarni, … Wolfgang Willner
Phytocoenologia (2015-07-01) https://doi.org/bdmw
DOI: 10.1127/phyto/2015/0050

61. **European Mire Vegetation Database: a gap-oriented database for European fens and bogs**
Tomáš Peterka, Martin Jiroušek, Michal Hájek, Borja Jiménez-Alfaro
Phytocoenologia (2015-11-01) https://doi.org/f724p4
DOI: 10.1127/phyto/2015/0054

62. **Vegetation Database of Albania**
Michele De Sanctis, Giuliano Fanelli, Alfred Mullaj, Fabio Attorre
Phytocoenologia (2017-01-01) https://doi.org/ghgt85
DOI: 10.1127/phyto/2017/0178

63. **Austrian Vegetation Database**
Wolfgang Willner, Christian Berg, Paul Heiselmayer
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcx
DOI: 10.7809/b-e.00125

64. **Bulgarian Vegetation Database: historic background, current status and future prospects**
Iva Apostolova, Desislava Sopotlieva, Hristo Pedashenko, Nikolay Velev, Kiril Vasilev
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvch
DOI: 10.7809/b-e.00069

65. **Swiss Forest Vegetation Database**
Thomas Wohlgemuth
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcz
DOI: 10.7809/b-e.00131

66. **Czech National Phytosociological Database: basic statistics of the available vegetation-plot data**
M. Chytrý, M. Rafajová
Preslia (2003)

67. **VegMV – the vegetation database of Mecklenburg-Vorpommern**
Florian Jansen, Jürgen Dengler, Christian Berg
Biodiversity & Ecology (2012-09-10) https://doi.org/gftw54
DOI: 10.7809/b-e.00070

68. **VegetWeb – the national online-repository of vegetation plots from Germany**
Jörg Ewald, Rudolf May, Martin Kleikamp
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcj
DOI: 10.7809/b-e.00073

69. **German Vegetation Reference Database (GVRD)**
Ute Jandt, Helge Bruelheide
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvc2
DOI: 10.7809/b-e.00146

70. **The phytosociological database SOPHY as the basis of plant socio-ecology and phytoclimatology in France**
Emmanuel Garbolino, Patrice De Ruffray, Henry Brisse, Gilles Grandjouan
Biodiversity & Ecology (2012-09-10) https://doi.org/ghhn9q
DOI: 10.7809/b-e.00074

71. **Hellenic Natura 2000 Vegetation Database (HelNatVeg)**
Panayotis Dimopoulos, Ioannis Tsiripidis
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvc3
DOI: 10.7809/b-e.00177

72. **Hellenic Woodland Database**
Georgios Fotiadis, Ioannis Tsiripidis, Erwin Bergmeier, Panayotis Dimopolous
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvc4
DOI: 10.7809/b-e.00178

73. **Phytosociological Database of Non-Forest Vegetation in Croatia**
Zvjezdana Stancic
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgt9f
DOI: 10.7809/b-e.00180

74. **Hungarian Phytosociological database (COENODATREF): sampling methodology, nomenclature and its actual stage**

K Lájer, Z. Botta-Dukát, J. Csiky, F. Horváth, F. Szmorad, I. Bagi, T. Rédei
Annali di Botanica, Nuova Serie (2008)

75. **VegItaly: The Italian collaborative project for a national vegetation database**
F. Landucci, A. T. R. Acosta, E. Agrillo, F. Attorre, E. Biondi, V. E. Cambria, A. Chiarucci, E. Del Vico, M. De Sanctis, L. Facioni, … R. Venanzoni
Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology (2012-12) https://doi.org/ghgt8x
DOI: 10.1080/11263504.2012.740093

76. **Italian National Vegetation Database (BVN/ISPRA)**
Laura Casella, Pietro Massimiliano Bianco, Pierangela Angelini, Emi Morroni
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvc6
DOI: 10.7809/b-e.00192

77. **Nationwide Vegetation Plot Database – Sapienza University of Rome: state of the art, basic figures and future perspectives**
Emiliano Agrillo*, Nicola Alessi, Marco Massimi, Francesco Spada, Michele De Sanctis
Phytocoenologia (2017-07-20) https://doi.org/gbsxm9
DOI: 10.1127/phyto/2017/0139

78. **Semi-natural Grassland Vegetation Database of Latvia**
Solvita Rūsiņa
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgt9g
DOI: 10.7809/b-e.00197

79. **Schatten voor de natuur. Achtergronden, inventaris en toepassingen van de Landelijke Vegetatie Databank**
J. H. J. Schaminée, J. A. M. Janssen, R. Haveman, S. M. Hennekens, G. B. M. Heuvelink, H. P. J. Huiskes, E. J. Weeda
KNNV Uitgeverij (2006)

80. **The Polish Vegetation Database: structure, resources and development**
Zygmunt Kącki, Michał Śliwiński
Acta Societatis Botanicorum Poloniae (2012) https://doi.org/f34f3k
DOI: 10.5586/asbp.2012.014

81. **Romanian Forest Database: a phytosociological archive of woody vegetation**
Adrian Indreica, Pavel Dan Turtureanu, Anna Szabó, Irina Irimia
Phytocoenologia (2017-12-01) https://doi.org/ghgt86
DOI: 10.1127/phyto/2017/0201

82. **The Romanian Grassland Database (RGD): historical background, current status and future perspectives**
Kiril Vassilev, Eszter Ruprecht, Valeriu Alexiu, Thomas Becker, Monica Beldean, Claudia Biță-Nicolae, Anna Mária Csergő, Iliana Dzhovanova, Eva Filipova, József Pál Frink, … Jürgen Dengler
Phytocoenologia (2018-03-01) https://doi.org/gc79hp
DOI: 10.1127/phyto/2017/0229

83. **Vegetation Database Grassland Vegetation of Serbia**
Svetlana Aćić, Milicia Petrović, Urban Šilc, Zora Dajić Stevanović
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgt9h
DOI: 10.7809/b-e.00206

84. **Lower Volga Valley Phytosociological Database**
Alexey Sorokin, Valentin Golub, Kseniya Starichkova, Lyudmila Nikolaychuk, Viktoria Bondareva, Tatyana Ivakhnova
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgt9j
DOI: 10.7809/b-e.00207

85. **Vegetation Database of the Volga and the Ural Rivers Basins**
Tatiana Lysenko, Olga Kalmykova, Anna Mitroshenkova
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvc7
DOI: 10.7809/b-e.00208

86. **Vegetation Database of Tatarstan**
Vadim Prokhorov, Tatiana Rogova, Maria Kozhevnikova
Phytocoenologia (2017-09-27) https://doi.org/ghgt84
DOI: 10.1127/phyto/2017/0172

87. **Vegetation Database of Slovenia**
Urban Šilc
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgt9k
DOI: 10.7809/b-e.00215

88. **Slovak Vegetation Database**
Jozef Šibík
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgt9m
DOI: 10.7809/b-e.00216

89. **Ukrainian Grasslands Database**
Anna Kuzemko
Biodiversity & Ecology (2012-09-10) https://doi.org/ghk7f3
DOI: 10.7809/b-e.00217

90. **The West African Vegetation Database**
Marco Schmidt, Thomas Janßen, Stefan Dressler, Karen Hahn, Mipro Hien, Souleymane Konaté, Anne Mette Lykke, Ali Mahamane, Bienvenu Sambou, Brice Sinsin, … Georg Zizka
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcf
DOI: 10.7809/b-e.00065

91. **Zur Vegetationsökologie der Savannenlandschaften im Sahel Burkina Fasos**
J. Müller
FB Biologie und Informatik, J.W. Goethe-Universität Frankfurt a.M (2003)

92. **ForestPlots.net: a web application and research tool to manage and analyse tropical forest plot data**
Gabriela Lopez-Gonzalez, Simon L. Lewis, Mark Burkitt, Oliver L. Phillips
Journal of Vegetation Science (2011-08) https://doi.org/dz6zb3
DOI: 10.1111/j.1654-1103.2011.01312.x

93. **Plot-scale evidence of tundra vegetation change and links to recent summer warming**
Sarah C. Elmendorf, Gregory H. R. Henry, Robert D. Hollister, Robert G. Björk, Noémie Boulanger-Lapointe, Elisabeth J. Cooper, Johannes H. C. Cornelissen, Thomas A. Day, Ellen Dorrepaal, Tatiana G. Elumeeva, … Sonja Wipf
Nature Climate Change (2012-04-08) https://doi.org/f223nb
DOI: 10.1038/nclimate1465

94. **Database of Masaryk University's Vegetation Research in Siberia**
Milan Chytrý
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcp
DOI: 10.7809/b-e.00088

95. **BIOTA Southern Africa Biodiversity Observatories Vegetation Database**
Gerhard Muche, Ute Schmiedel, Norbert Jürgens
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcg
DOI: 10.7809/b-e.00066

96. **Vegetation Database of the Okavango Basin**
Rasmus Revermann, Amândio Luis Gomes, Francisco Maiato Gonçalves, Johannes Wallenfang, Torsten Hoche, Norbert Jürgens, Manfred Finckh
Phytocoenologia (2016-06-01) https://doi.org/ghgt82
DOI: 10.1127/phyto/2016/0103

97. **Conventional tree height–diameter relationships significantly overestimate aboveground carbon stocks in the Central Congo Basin**
Elizabeth Kearsley, Thales de Haulleville, Koen Hufkens, Alidé Kidimbu, Benjamin Toirambe, Geert Baert, Dries Huygens, Yodit Kebede, Pierre Defourny, Jan Bogaert, … Hans Verbeeck
Nature Communications (2013-08-05) https://doi.org/ghgt8w
DOI: 10.1038/ncomms3269 · PMID: 23912554

98. **Responses of plant functional types to environmental gradients in the south-west Ethiopian highlands**
Desalegn Wana, Carl Beierkuhnlein
Journal of Tropical Ecology (2011-03-10) https://doi.org/b6mtmx
DOI: 10.1017/s0266467410000799

99. **Vegetation Database of Southern Morocco**
Manfred Finckh
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcq
DOI: 10.7809/b-e.00094

100. **{Das Weidepotential im Gutu-Distrikt (Zimbabwe) – Möglichkeiten und Grenzen der Modellierung unter Verwendung von Landsat TM-5**
C. Samimi
Karlsruher Schriften zur Geographie und Geoökologie (2003)

101. **Classification of Korean forests: patterns along geographic and environmental gradients**
Tomáš Černý, Martin Kopecký, Petr Petřík, Jong-Suk Song, Miroslav Šrůtek, Milan Valachovič, Jan Altman, Jiří Doležal
Applied Vegetation Science (2015-01) https://doi.org/ghgt8z
DOI: 10.1111/avsc.12124

102. **Vegetation of Middle Asia – the project state of art after ten years of survey and future perspectives**
Arkadiusz Nowak, Marcin Nobis, Sylwia Nowak, Agnieszka Nobis, Grzegorz Swacha, Zygmunt Kącki
Phytocoenologia (2017-12-01) https://doi.org/gctffg
DOI: 10.1127/phyto/2017/0208

103. **Vegetation of the woodland-steppe transition at the southeastern edge of the Inner Mongolian Plateau**

Hongyan Liu, Haiting Cui, Richard Pott, Martin Speier
Journal of Vegetation Science (2000-08) https://doi.org/cxr92b
DOI: 10.2307/3246582

104. **Combined effects of livestock grazing and abiotic environment on vegetation and soils of grasslands across Tibet**
Yun Wang, Gwendolyn Heberling, Eugen Görzen, Georg Miehe, Elke Seeber, Karsten Wesche
Applied Vegetation Science (2017-07) https://doi.org/gbkd6v
DOI: 10.1111/avsc.12312

105. **Community assembly during secondary forest succession in a Chinese subtropical forest**
Helge Bruelheide, Martin Böhnke, Sabine Both, Teng Fang, Thorsten Assmann, Martin Baruffol, Jürgen Bauhus, François Buscot, Xiao-Yong Chen, Bing-Yang Ding, … Bernhard Schmid
Ecological Monographs (2011-02) https://doi.org/dmwpsm
DOI: 10.1890/09-2172.1

106. **Vegetation Database of Sinai in Egypt**
Mohamed Hatim
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcr
DOI: 10.7809/b-e.00099

107. **Eurosiberian meadows at their southern edge: patterns and phytogeography in the NW Tien Shan**
Viktoria Wagner
Journal of Vegetation Science (2009-03-25) https://doi.org/ftq2r6
DOI: 10.1111/j.1654-1103.2009.01032.x

108. **Plant communities of the southern Mongolian Gobi**
Henrik von Wehrden, Karsten Wesche, Georg Miehe
Phytocoenologia (2009-10-21) https://doi.org/ddvj9h
DOI: 10.1127/0340-269x/2009/0039-0331

109. **Wetland Vegetation Database of Baikal Siberia (WETBS)**
Victor Chepinoga
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcs
DOI: 10.7809/b-e.00107

110. **Eastern Pamirs – A vegetation-plot database for the high mountain pastures of the Pamir Plateau (Tajikistan)**
Kim André Vanselow
Phytocoenologia (2016-06-01) https://doi.org/f952sp
DOI: 10.1127/phyto/2016/0122

111. **Socotra Vegetation Database**
Michele De Sanctis, Fabio Attorre
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvct
DOI: 10.7809/b-e.00111

112. **Terrestrial Ecosystem Research Infrastructures**
Informa UK Limited
(2017-03-03) https://doi.org/ghgt87
DOI: 10.1201/9781315368252

113. **Structural and floristic diversity of mixed tropical rain forest in New Caledonia: new data from the New Caledonian Plant Inventory and Permanent Plot Network (NC-PIPPN)**
Thomas Ibanez, Jérôme Munzinger, Gilles Dagostini, Vanessa Hequet, Frédéric Rigault, Tanguy Jaffré, Philippe Birnbaum
Applied Vegetation Science (2014-07) https://doi.org/f57bfw
DOI: 10.1111/avsc.12070

114. **Managing biodiversity information: development of New Zealand's National Vegetation Survey databank**
S. K. Wiser, P. J. Bellingham, L. E. Burrows
New Zealand Journal of Ecology (2001) https://www.jstor.org/stable/24055293

115. **Species Richness, Forest Structure, and Functional Diversity During Succession in the New Guinea Lowlands**
Timothy J. S. Whitfeld, Jesse R. Lasky, Kipiro Damas, Gibson Sosanika, Kenneth Molem, Rebecca A. Montgomery
Biotropica (2014-09) https://doi.org/f6hf36
DOI: 10.1111/btp.12136

116. **The Tree Biodiversity Network (BIOTREE-NET): prospects for biodiversity research and conservation in the Neotropics**
Luis Cayuela, Lucía Gálvez-Bravo, Ramón Pérez Pérez, Fábio de Albuquerque, Duncan Golicher, Rakan Zahawi, Neptalí Ramírez-Marcial, Cristina Garibaldi, Richard Field, José Rey Benayas, … Regino Zamora
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvck
DOI: 10.7809/b-e.00078

117. **Timberline meadows along a 1000-km transect in NW North America: species diversity and community patterns**
Viktoria Wagner, Toby Spribille, Stefan Abrahamczyk, Erwin Bergmeier
Applied Vegetation Science (2014-01) https://doi.org/f5mpvm
DOI: 10.1111/avsc.12045

118. **How resilient are northern hardwood forests to human disturbance? An evaluation using a plant functional group approach**
I. Aubin, S. Gachet, C. Messier, A. Bouchard
Ecoscience (2007)

119. **Vegetation and altitudinal zonation in continental West Greenland**
B. Sieg, B. Drees, F. J. A. Daniëls
Meddelelser om Grønland Bioscience (2006)

120. **VegBank – a permanent, open-access archive for vegetation-plot data**
Robert Peet, Michael Lee, Michael Jennings, Don Faber-Langendoen
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcm
DOI: 10.7809/b-e.00080

121. **Vegetation-plot database of the Carolina Vegetation Survey**
Robert Peet, Michael Lee, Forbes Boyle, Thomas Wentworth, Michael Schafale, Alan Weakley
Biodiversity & Ecology (2012-09-10) https://doi.org/ghgvcn
DOI: 10.7809/b-e.00081

122. **The Alaska Arctic Vegetation Archive (AVA-AK)**
Donald A. Walker, Amy L. Breen, Lisa A. Druckenmiller, Lisa W. Wirth, Will Fisher, Martha K. Raynolds, Jozef Šibík, Marilyn D. Walker, Stephan Hennekens, Keith Boggs, … Donatella Zona
Phytocoenologia (2016-09-01) https://doi.org/f877ht
DOI: 10.1127/phyto/2016/0128

123. **VegPáramo, a flora and vegetation database for the Andean páramo**
Gwendolyn Peyre, Henrik Balslev, David Martí, Petr Sklenář, Paul Ramsay, Pablo Lozano, Nidia Cuello, Rainer Bussmann, Omar Cabrera, Xavier Font
Phytocoenologia (2015-07-01) https://doi.org/f7m9cj
DOI: 10.1127/phyto/2015/0045

124. **The Floristic and Forest Inventory of Santa Catarina State (IFFSC): methodological and operational aspects**
A. C. Vibrans, L. Sevgnani, D. V. Lingner, A. L. Gasper, S. Sabbagh
Pesquisa Florestal Brasileira (2010)

125. **Plant Invasions in Protected Areas**
Springer Science and Business Media LLC
(2013) https://doi.org/ghgt8v
DOI: 10.1007/978-94-007-7750-7

126. **The Ecozones of the World**
Jürgen Schultz
Springer Science and Business Media LLC (2005) https://doi.org/ft52nn
DOI: 10.1007/3-540-28527-x

127. **A global inventory of mountains for bio-geographical applications**
Christian Körner, Walter Jetz, Jens Paulsen, Davnah Payne, Katrin Rudmann-Maurer, Eva M. Spehn
Alpine Botany (2016-12-19) https://doi.org/f93fmr
DOI: 10.1007/s00035-016-0182-6

Supplementary Material

Table 1: List of databases contributing to the open access dataset extracted from the sPlot database. Databases are ordered based on their ID in the Global Index of Vegetation Databases (GVID ID).

GIVD ID	Dataset name	Custodian	Deputy custodian	Nr. OA plots	Ref
00-00-004	Vegetation Database of Eurasian Tundra	Risto Virtanen		600	
00-RU-001	Vegetation Database Forest of Southern Ural	Vasiliy Martynenko	Pavel Shirokikh	25	
00-RU-003	Database Meadows and Steppes of Southern Ural	Sergey Yamalov	Mariya Lebedeva	99	
00-TR-001	Forest Vegetation Database of Turkey - FVDT	Ali Kavgacı		15	
EU-00-002	Nordic-Baltic Grassland Vegetation Database (NBGVD)	Jürgen Dengler	Łukasz Kozub	931	54
EU-00-011	Vegetation-Plot Database of the University of the Basque Country (BIOVEG)	Idoia Biurrun	Itziar García-Mijangos	1694	55
EU-00-013	Balkan Dry Grasslands Database	Kiril Vassilev	Armin Macanović	224	56
EU-00-016	Mediterranean Ammophiletea Database	Corrado Marcenò	Borja Jiménez-Alfaro	3713	57
EU-00-017	European Coastal Vegetation Database	John Janssen		1369	
EU-00-018	The Nordic Vegetation Database	Jonathan Lenoir	Jens-Christian Svenning	1755	58
EU-00-019	Balkan Vegetation Database	Kiril Vassilev	Hristo Pedashenko	211	59
EU-00-020	WetVegEurope	Flavia Landucci		61	60
EU-00-022	European Mire Vegetation Database	Tomáš Peterka	Martin Jiroušek	1843	61
EU-AL-001	Vegetation Database of Albania	Michele De Sanctis	Giuliano Fanelli	99	62
EU-AT-001	Austrian Vegetation Database	Wolfgang Willner	Christian Berg	950	63
EU-BE-002	INBOVEG	Els De Bie		48	
EU-BG-001	Bulgarian Vegetation Database	Iva Apostolova	Desislava Sopotlieva	74	64
EU-CH-005	Swiss Forest Vegetation Database	Thomas Wohlgemuth		1409	65
EU-CZ-001	Czech National Phytosociological Database	Milan Chytrý	Ilona Knollová	579	66
EU-DE-001	VegMV	Florian Jansen	Christian Berg	5	67
EU-DE-013	VegetWeb Germany	Florian Jansen	Jörg Ewald	199	68
EU-DE-014	German Vegetation Reference Database (GVRD)	Ute Jandt	Helge Bruelheide	286	69
EU-DK-002	National Vegetation Database of Denmark	Jesper Erenskjold Moeslund	Rasmus Ejrnæs	1181	
EU-ES-001	Iberian and Macaronesian Vegetation Information System (SIVIM) - Wetlands	Aaron Pérez-Haase	Xavier Font	292	
EU-FR-003	SOPHY	Emmanuel Garbolino	Patrice De Ruffray	13322	70

GIVD ID	Dataset name	Custodian	Deputy custodian	Nr. OA plots	Ref
EU-GB-001	UK National Vegetation Classification Database	John S. Rodwell		5457	
EU-GR-001	KRITI	Erwin Bergmeier		43	
EU-GR-005	Hellenic Natura 2000 Vegetation Database (HelNatVeg)	Panayotis Dimopoulos	Ioannis Tsiripidis	777	71
EU-GR-006	Hellenic Woodland Database	Ioannis Tsiripidis	Georgios Fotiadis	4	72
EU-HR-001	Phytosociological Database of Non-Forest Vegetation in Croatia	Zvjezdana Stančić		213	73
EU-HR-002	Croatian Vegetation Database	Željko Škvorc	Daniel Krstonošić	688	
EU-HU-003	CoenoDat Hungarian Phytosociological Database	János Csiky	Zoltán Botta-Dukát	17	74
EU-IT-001	VegItaly	Roberto Venanzoni	Flavia Landucci	2712	75
EU-IT-010	Vegetation database of Habitats in the Italian Alps – HabItAlp	Laura Casella	Pierangela Angelini	155	76
EU-IT-011	Vegetation-Plot Database Sapienza University of Rome (VPD-Sapienza)	Emiliano Agrillo	Fabio Attorre	1003	77
EU-LT-001	Lithuanian Vegetation Database	Valerijus Rašomavičius	Domas Uogintas	119	
EU-LV-001	Semi-natural Grassland Vegetation Database of Latvia	Solvita Rūsiņa		306	78
EU-MK-001	Vegetation Database of the Republic of Macedonia	Renata Ćušterevska		10	
EU-NL-001	Dutch National Vegetation Database	Stephan M. Hennekens	Joop H.J. Schaminée	10223	79
EU-PL-001	Polish Vegetation Database	Zygmunt Kącki	Grzegorz Swacha	464	80
EU-RO-007	Romanian Forest Database	Adrian Indreica	Pavel Dan Turtureanu	60	81
EU-RO-008	Romanian Grassland Database	Eszter Ruprecht	Kiril Vassilev	44	82
EU-RS-002	Vegetation Database Grassland Vegetation of Serbia	Svetlana Aćić	Zora Dajić Stevanović	57	83
EU-RU-002	Lower Volga Valley Phytosociological Database	Valentin Golub	Andrey Chuvashov	149	84
EU-RU-003	Vegetation Database of the Volga and the Ural Rivers Basins	Tatiana Lysenko		96	85
EU-RU-011	Vegetation Database of Tatarstan	Vadim Prokhorov	Maria Kozhevnikova	94	86
EU-SI-001	Vegetation Database of Slovenia	Urban Šilc	Filip Küzmič	435	87
EU-SK-001	Slovak Vegetation Database	Milan Valachovič	Jozef Šibík	893	88
EU-UA-001	Ukrainian Grasslands Database	Anna Kuzemko	Yulia Vashenyak	149	89
EU-UA-006	Vegetation Database of Ukraine and Adjacent Parts of Russia	Viktor Onyshchenko	Vitaliy Kolomiychuk	479	

GIVD ID	Dataset name	Custodian	Deputy custodian	Nr. OA plots	Ref
AF-00-001	West African Vegetation Database	Marco Schmidt	Georg Zizka	184	90
AF-00-008	PANAF Vegetation Database	Hjalmar Kühl	TeneKwetche Sop	942	
AF-BF-001	Sahel Vegetation Database	Jonas V. Müller	Marco Schmidt	279	91
00-00-001	ForestPlots.net	Oliver L. Phillips	Aurora Levesley	108	92
00-00-003	SALVIAS	Brian Enquist	Brad Boyle	2860	
00-00-005	Tundra Vegetation Plots (TundraPlot)	Anne D. Bjorkman	Sarah Elmendorf	227	93
00-RU-002	Database of Masaryk University`s Vegetation Research in Siberia	Milan Chytrý		128	94
AF-00-003	BIOTA Southern Africa Biodiversity Observatories Vegetation Database	Norbert Jürgens	Ute Schmiedel	562	95
AF-00-006	SWEA-Dataveg	Miguel Alvarez	Michael Curran	1211	
AF-00-009	Vegetation Database of the Okavango Basin	Rasmus Revermann	Manfred Finckh	202	96
AF-CD-001	Forest Database of Central Congo Basin	Kim Sarah Jacobsen	Hans Verbeeck	97	97
AF-ET-001	Vegetation Database of Ethiopia	Desalegn Wana	Anke Jentsch	59	98
AF-MA-001	Vegetation Database of Southern Morocco	Manfred Finckh		266	99
AF-ZW-001	Vegetation Database of Zimbabwe	Cyrus Samimi		17	100
AS-00-001	Korean Forest Database	Tomáš Černý	Jiri Dolezal	766	101
AS-00-003	Vegetation of Middle Asia	Arkadiusz Nowak	Marcin Nobis	128	102
AS-00-004	Rice Field Vegetation Database	Arkadiusz Nowak		31	
AS-BD-001	Tropical Forest Dataset of Bangladesh	Mohammed A.S. Arfin Khan	Fahmida Sultana	82	
AS-CN-001	China Forest-Steppe Ecotone Database	Hongyan Liu	Fengjun Zhao	97	103
AS-CN-002	Tibet-PaDeMoS Grazing Transect	Karsten Wesche		27	104
AS-CN-003	Vegetation Database of the BEF China Project	Helge Bruelheide		18	105
AS-CN-004	Vegetation Database of the Northern Mountains in China	Zhiyao Tang		70	
AS-EG-001	Vegetation Database of Sinai in Egypt	Mohamed Z. Hatim		98	106
AS-ID-001	Sulawesi Vegetation Database	Michael Kessler		24	
AS-IR-001	Vegetation Database of Iran	Jalil Noroozi	Parastoo Mahdavi	105	
AS-KZ-001	Database of Meadow Vegetation in the NW Tien Shan Mountains	Viktoria Wagner		3	107
AS-MN-001	Southern Gobi Protected Areas Database	Henrik von Wehrden	Karsten Wesche	688	108
AS-RU-001	Wetland Vegetation Database of Baikal Siberia (WETBS)	Victor Chepinoga		6	109
AS-RU-002	Database of Siberian Vegetation (DSV)	Andrey Korolyuk	Andrei Zverev	2150	

GIVD ID	Dataset name	Custodian	Deputy custodian	Nr. OA plots	Ref
AS-RU-004	Database of the University of Münster - Biodiversity and Ecosystem Research Group's Vegetation Research in Western Siberia and Kazakhstan	Norbert Hölzel	Wanja Mathar	85	
AS-SA-001	Vegetation Database of Saudi Arabia	Mohamed Abd El-Rouf Mousa El-Sheikh		607	
AS-TJ-001	Eastern Pamirs	Kim André Vanselow		174	110
AS-TW-001	National Vegetation Database of Taiwan	Ching-Feng Li	Chang-Fu Hsieh	897	
AS-YE-001	Socotra Vegetation Database	Michele De Sanctis	Fabio Attorre	190	111
AU-AU-002	AEKOS	Ben Sparrow		7443	112
AU-NC-001	New Caledonian Plant Inventory and Permanent Plot Network (NC-PIPPN)	Jérôme Munzinger	Philippe Birnbaum	98	113
AU-NZ-001	New Zealand National Vegetation Databank	Susan Wiser		983	114
AU-PG-001	Forest Plots from Papua New Guinea	Timothy Whitfeld	George D. Weiblen	53	115
NA-00-002	Tree Biodiversity Network (BIOTREE-NET)	Luis Cayuela		208	116
NA-CA-003	Database of Timberline Vegetation in NW North America	Viktoria Wagner	Toby Spribille	38	117
NA-CA-004	Understory of Sugar Maple Dominated Stands in Quebec and Ontario (Canada)	Isabelle Aubin		9	118
NA-CA-005	Boreal Forest of Canada	Yves Bergeron	Louis De Grandpré	44	
NA-GL-001	Vegetation Database of Greenland	Birgit Jedrzejek	Fred J.A. Daniëls	340	119
NA-US-002	VegBank	Robert K. Peet	Michael T. Lee	6456	120
NA-US-006	Carolina Vegetation Survey Database	Robert K. Peet	Michael T. Lee	2317	121
NA-US-014	Alaska-Arctic Vegetation Archive	Donald A. Walker	Amy Breen	467	122
SA-00-002	VegPáramo	Gwendolyn Peyre	Xavier Font	1591	123
SA-AR-002	Vegetation Database of Central Argentina	Melisa Giorgis	Alicia T.R. Acosta	42	
SA-BO-003	Bolivia Forest Plots	Michael Kessler	Sebastian Herzog	18	
SA-BR-002	Forest Inventory, State of Santa Catarina, Brazil (IFFSC Project)	Alexander Christian Vibrans	André Luís de Gasper	1345	124
SA-BR-003	Grasslands of Rio Grande do Sul, Brazil	Eduardo Vélez-Martin	Valério De Patta Pillar	271	
SA-BR-004	Grassland Database of Campos Sulinos	Gerhard E. Overbeck	Valério De Patta Pillar	111	
SA-CL-002	SSAForests_Plots_db	Alvaro G. Gutierrez		163	
SA-CL-003	Chilean Park Transects - Fondecyt 1040528	Aníbal Pauchard	Alicia Marticorena	33	125
SA-EC-001	Ecuador Forest Plot Database	Jürgen Homeier		156	

Table 2: Description of the variables contained in the 'header' matrix, together with their range (if numeric) or possible levels (if nominal or binary), and the number of non-empty (i.e., non NA) records. Variable types can be n - nominal (i.e., qualitative variable), o - ordinal, q - quantitative, or b - binary (i.e., boolean), or d - date. . Additional details on the

variables is in Bruelheide et al. (2019) [24]. GIVD codes derive from Dengler et al. (2011) [35]. Biomes refer to Schultz 2005 [126], modified to include also the world mountain regions by Körner et al. (2017)[127]. The column ESY refers to the EUNIS Habitat Classification Expert system described in Chytrý et al. (2020) [48].

Variable	Range/Levels	Unit of Measurement	Nr. non-NA Records	Type
GIVD_ID			91205	n
Dataset			91205	n
Continent	Africa, Asia, Europe, North America, Oceania, South America		91205	n
Country			91205	n
Biome	Alpine, Boreal zone, Dry midlatitudes, Dry tropics and subtropics, Polar and subpolar zone, Subtrop. with year-round rain, Subtropics with winter rain, Temperate midlatitudes, Tropics with summer rain, Tropics with year-round rain		91205	n
Date_of_recording	1888-07-05 - 2015-02-03	dd-mm-yyyy	75971	d
Latitude	-54.73863 - 80.149116	° (WGS84)	91205	q
Longitude	-162.741433 - 179.590053	° (WGS84)	91205	q
Location_uncertainty	1 - 2500	m	91176	q
Releve_area	0.01 - 40000	m^2	62063	q
Plant_recorded	All vascular plants, All trees & dominant understory, Dominant trees, Only dominant species, Dominant woody plants >= 2.5 cm dbh, All woody plants, Woody plants >= 1 cm dbh, Woody plants >= 2.5 cm dbh, Woody plants >= 5 cm dbh, Woody plants >= 10 cm dbh, Woody plants >= 20 cm dbh, Woody plants >= 1 m height, Not specified		91205	n
Elevation	-25 - 4819	m a.s.l.	52277	q
Aspect	0 - 360	°	30842	q
Slope	0 - 90	°	37817	q
is_forest	FALSE = 58145; TRUE = 25740		83885	b
ESY			55631	n
Forest	FALSE = 50071; TRUE = 23979		74050	b
Shrubland	FALSE = 62967; TRUE = 11083		74050	b
Grassland	FALSE = 26974; TRUE = 47076		74050	b
Wetland	FALSE = 55970; TRUE = 18080		74050	b
Sparse_vegetation	FALSE = 62728; TRUE = 11322		74050	b
Cover_total	1 - 313	%	24850	q
Cover_tree_layer	0.5 - 150	%	7270	q
Cover_shrub_layer	0.5 - 145	%	10209	q
Cover_herb_layer	0.2 - 180	%	26846	q
Cover_moss_layer	1 - 100	%	9685	q
Cover_lichen_layer	1 - 95	%	739	q

Variable	Range/Levels	Unit of Measurement	Nr. non-NA Records	Type
Cover_algae_layer	1 - 100	%	221	q
Cover_litter_layer	1 - 100	%	4510	q
Cover_bare_rocks	1 - 100	%	1904	q
Cover_cryptogams	1 - 95	%	593	q
Cover_bare_soil	0.1 - 99	%	1414	q
Height_trees_highest	1 - 99	m	6140	q
Height_trees_lowest	1 - 90	m	246	q
Height_shrubs_highest	0.1 - 9.9	m	2902	q
Height_shrubs_lowest	0.1 - 9	m	350	q
Height_herbs_average	0.1 - 440	cm	10161	q
Height_herbs_lowest	1 - 250	cm	2809	q
Height_herbs_highest	1 - 600	cm	1744	q
Naturalness	1 = Natural, 2 = Semi-natural		68179	o