sPlot

a project of iDiv

– sPlot Letter No. 3 –

Bayreuth, Leipzig and Halle, 12 December 2014

Dear members of the sPlot Consortium,

Last week we had a successful second sPlot Workshop in Leipzig, and thus there is plenty to report, despite the last sPlot Letter being less than one month old.

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2nd sPlot Workshop, 2–5 December 2014

From 2–5 December, the second sPlot Workshop took place at iDiv in Leipzig, preceded by a preparatory meeting of the sPlot Steering Committee and Core Team on Monday, 1 December. In total, **28 scientists from nine countries and four continents** participated. They were an exciting mixture of representatives of big plot databases (Czech National Database, GVRD and VegMV/Germany, AEKOS/Australia, BIOTA-Western Africa, BIOTA-Southern Africa), trait databases (TRY), theoretical ecologists and specialists for elaborate statistical analyses that combine plot data, trait data, phylogenies, climate data and remote sensing products.

One week before the workshop, the sPlot version 1.0 has been released (see below) and in an intensive action (mainly by Oliver Purschke and Helge Bruelheide) until shortly before the workshop the sPlot output was cleaned and prepared to match a uniform taxonomic backbone and via that the trait data from the TRY database (see below). The workshop started with overviews on the now available plot data in sPlot and their properties as well as the situation in TRY. Subsequently, a sequence of plenaries and several break-out groups led to the development of various paper ideas, elaborating these paper concepts in more detail and testing, refining and/or rejecting analytical approaches to use the gigantic datasets. The work atmosphere was very creative and productive and the feeling among the participants was a bit like opening a door to a whole new world of ecology because for the first time we are able to combine fine grain community data across the largest possible geographical and environmental extent, which is the whole earth. The participants also identified shortcomings of the present data, such as incomplete or missing header data of many plots and insufficient coverage in

some biomes and continents and agreed on steps how to remedy these issues in the next few months. In the final plenary, eight promising paper ideas were identified that have been started during the workshop and will be completed in 2015 (see below).

Fig. 1: The participants of the sPlot II Workshop in front of the German National Library, Leipzig, 2 December 2014. From left to right, first row: Helge Bruelheide, Jürgen Dengler, Brody Sandel, Richard Field, Christine Römermann; second row: Valerio De Patta Pillar, Anita Smyth, Tiffany Knight, Robert Peet, Cyrille Violle, Milan Chytrý; third row: Ute Jandt, Oliver Purschke, Marco Schmidt, Florian Jansen, Marten Winter, Miguel Mahecha, Jonathan Chase, Borja Jímenez-Alfaro; last row: Norbert Jürgens, Jonathan Lenoir, Nathan Swenson, Tene Kwetche Sop, Hjalmar Kühl, Peter van Bodegom, Jens Kattge (Photo: sDiv).

Database sPlot 1.0, released on 20 November 2014

After the preliminary sPlot databases 0.1 (from April 2014) and 0.2 (from August 2014), the first version to be used for real analyses is sPlot 1.0, released by our database manager Stephan Hennekens on 20 November 2014, slightly more than one week before the workshop and basis for all tests and analyses carried out during the workshop.

sPlot 1.0 contains **52 databases[1] and 659,000 plots from 62 countries**:

- Europe (including Turkey), contributed via EVA: 40 databases, 611,397 plots
- Africa, Asia, Australasia: 10 databases, 46,895 plots
- Americas: 1 database, 427 plots

For certain analyses, we can additionally rely on cooperation with the French SOPHY database (209,000 plots), so that **in total there are presently c. 840,000 plots worldwide, of which c. 700,000 are georeferenced** (see Figs. 2 and 3).

[1] Note that in sPlot Letter No. 2, some of the present databases were still divided into several sub-databases, meaning that the actual number of databases has increased by 13 since August.

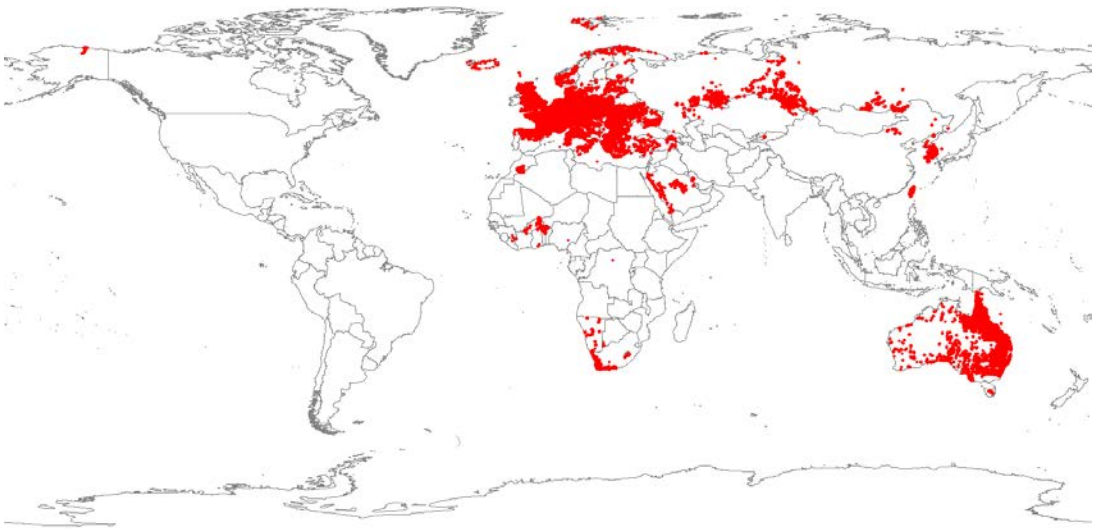

Fig. 2: Geographic distribution of vegetation plots in sPlot 1.0.

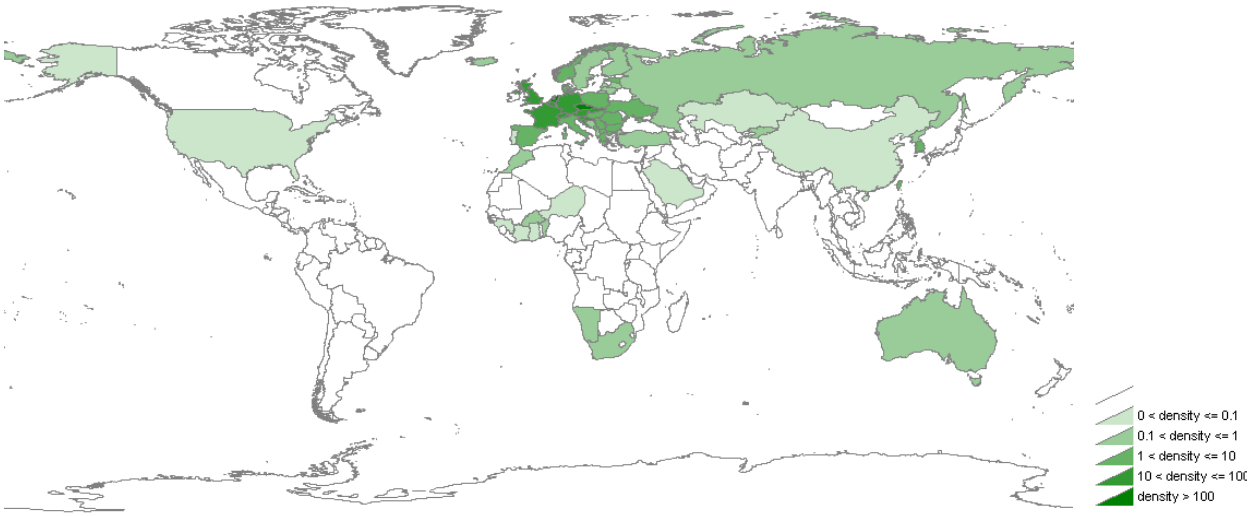

Fig. 3: Density of vegetation plots (number per 100 km²) per country as contained in sPlot 1.0 (note the log-scale; some countries in the lightest green have only 0.002 plots per 100 km², namely the USA and China).

In sPlot meanwhile all nine ecozones (zonobiomes) were represented so that we could reasonably conduct comparisons of trait-environment relationships across these. However, the coverage of six of the nine ecozones calls for improvement (Table 1).

Table 1: Distribution of vegetation plots in sPlot 1.0 across the nine ecozones (note that densities are multiplied by 10,000 compared to Fig. 3).

Ecozone (according to Schultz)	Number of plots	Plots per 1,000,000 km²	Coverage
1 – Tropics with year-round rain	1,358	109	Very poor
2 – Tropics with summer rain	5,394	220	Poor
3 – Dry tropics and subtropics	9,998	323	Poor
4 – Subtropics with winter rain	78,185	29,274	Good
5 – Subtropics with year-round rain	12,179	2,030	Moderate
6 – Temperate midlatitudes	588,419	40,581	Good
7 – Dry midlatitudes	5,644	342	Poor
8 – Boreal zone	8,133	417	Poor
9 – Polar and subpolar zone	1,378	230	Poor

First analyses of community-based trait-environment relationships across the globe

For our test analyses, we had received a version of TRY 2.0 with a fully gap-filled trait matrix for 18 major traits and c. 46,000 species. Gap-filling imputes values for traits in species where no measurement has been available, based on an algorithm frequently used by recommendation systems. This algorithm has been shown to be effective and reliable (Shan et al. 2012, ICML). In consequence, we could work with complete sets of 18 traits for about 40% of the species occurring in the sPlot plots. When considering the species weighted by frequency or cover, we achieved even a trait coverage of around 60% with relatively little differences between the ecozones. The following Figures 4 and 5 show two examples of preliminary analyses that illustrate the kind of analyses are now possible with the combination of sPlot with TRY.

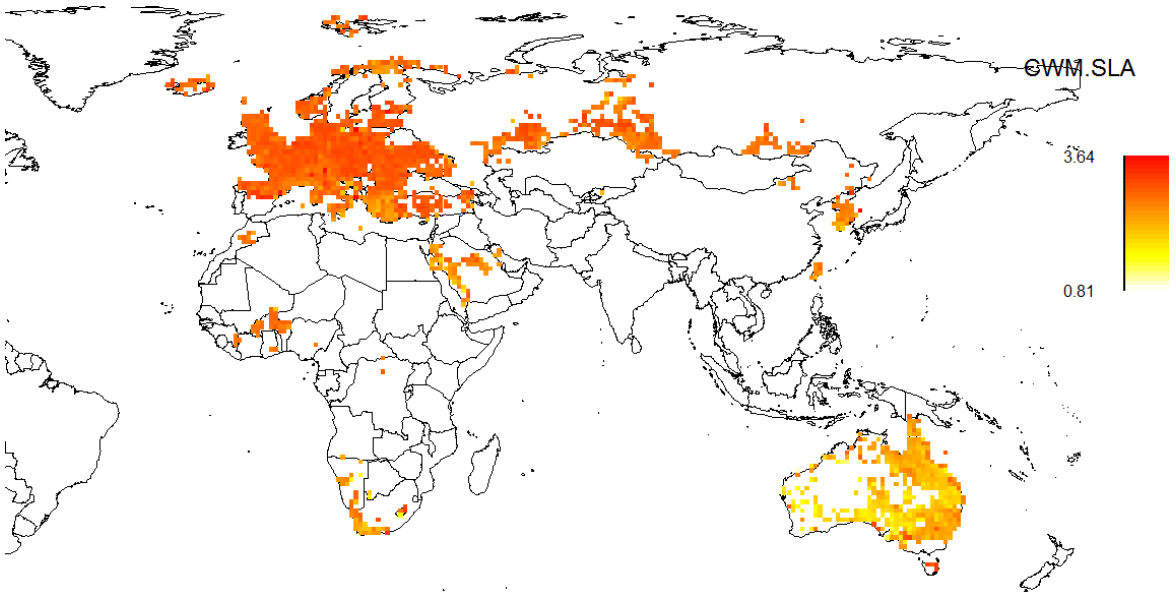

Fig. 4: Community-weighted means of specific-leaf area (SLA) in m²/kg (ln-transformed) averaged across all plots within a grid cell (values ranging from 2.2 to 38.1 m²/kg). SLA is highest in the Temperate midlatitudes from where it decreases towards the poles, towards the interiors of the contents and towards the subtropics and tropics (based on sPlot 1.0 and a fully gap-filled version of TRY 2.0).

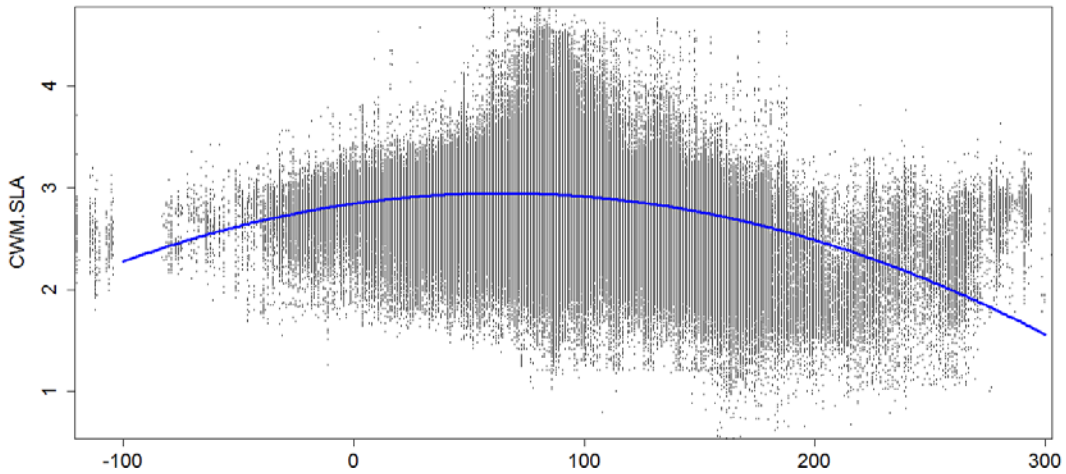

Fig. 5: Community-weighted means of specific-leaf area (SLA) in m²/kg (ln-transformed) regressed against mean annual temperature (MAT) [in °C · 10]. SLA is highest at about 9 °C. (raw analysis based on all approx.. 700,000 plots from sPlot 1.0 and a fully gap-filled version of TRY 2.0).

Next steps and an important deadline

Just after the workshop, TRY has released version 3.0 of its global trait database, with more or less doubled number of trait entries compared to version 2.0 (www.try-db.org). The gap-filled version of TRY 3.0 is supposed to be available in early 2015.

We decided that we will also use the next 2 1/2 months to expand the content of sPlot systematically and to improve the entries in some essential header data fields of already included data. Thus we ask now for contribution of additional medium to big vegetation-plot databases to reduce our geographical imbalance and to achieve a better coverage of all nine ecozones (zonobiomes). This means that we are **particularly looking for data from South America, North America, South Asia, Oceania and tropical and subtropical Africa**. In terms of ecozones, most urgently needed (in this sequence) are plots from the **(a) Tropics with year-round rain, (b) Tropics with summer rain, (c) Polar and subpolar zone, (d) Dry tropics and subtropics, (e) Dry midlatitudes and (f) Boreal zone**. But of course, we also accept data from the three already reasonably well-covered ecozones (Subtropics with winter rain = Mediterranean; Subtropics with year-round rain and Temperate midlatitudes) if they come from outside Europe (data from European regions are handled by EVA, see below).

We prefer bigger databases that cover a larger geographical extent and plots with full species composition and cover. However, in underrepresented regions and ecozones, we also accept well-curated smaller databases, in the case of (a) and (b) exceptionally also plots where only the woody species have been recorded and or only presence/absence or basal area. **Deadline for submission of databases (or updates of your already contributed databases) is 31 January 2015**. A vegetation-plot database that we have received by then and that is in reasonably good shape and well-documented has a **good chance to be included into sPlot prior to the release of version 2.0, which will be the basis for the first sPlot papers for which manuscripts were planned on the workshop in Leipzig** (see next section). Joining sPlot with a further database before that deadline would not only improve sPlot's global coverage, but also will give the contributors the chance to actively contribute to these first and potentially very high-ranking papers. Thus, if you have not yet decided whether to participate you might consider this soon, because the first wave of papers will all carry out global analyses based on the sPlot version 2.0 database, irrespective of whether further updates will follow later that year. Thus, joining now will give you the perspective of becoming co-author of these papers.

Thus, if you have an own **database not yet or only partly contributed** or you **know of other colleagues and institutions with suitable databases that could fill our gaps**, please inform Jürgen Dengler (contact at the bottom of this letter). For a first contact, it would be good if you could provide some rough information on approximate number of plots, geographic extent of the study area, whether plots have geographic coordinates and plot sizes, whether all species (or only woody ones or another subset) have been sampled and which performance measure was used (cover, basal area, presence/absence) and in which format the data can be contributed (preferred are Turboveg 2, a single spreadsheet or one spreadsheet for header data and a second for species data). Let us know whether we can contact the respective database owner/custodian directly or contacting should be done via you. Please don't send data without request from our side, but first discuss the suitability and the proper format with Jürgen Dengler. If a potentially interested database, needs more information about sPlot, you can direct them to our homepage http://www.idiv.de/sdiv/workshops/workshops-2013/splot and specifically to our Governance and Data Property Rules (http://www.idiv.de/sdiv/workshops/workshops-2013/splot/materials/content_56450/sPlot-Rules_approved.pdf). We anticipate that in sPlot 2.0 we can include 15–30 additional extra-European databases, but to achieve this we have to start soon with the preparation of the first incoming datasets because this always involves quite some work before we can upload them in

sPlot. Therefore, we kindly ask you to send the data as early as possible and preferably not all on the last days before the deadline.

Databases from North or South America are particularly welcome and can be directly incorporated into sPlot. If these databases are already part of the BIEN network, we would prefer the data to be provided through BIEN (For the BIEN Data Use Policy, see (http://bien.nceas.ucsb.edu/bien/biendata/data-use-policy/). Of course, will also accept databases from custodians who prefer to join only the sPlot Consortium and not BIEN.

Larger databases from Europe are also welcome, but they must be provided through our European partner EVA (http://euroveg.org/eva-database). In this case, please contact Milan Chytrý (chytry@sci.muni.cz) in case of newly contributed databases and Ilona Knollová (ikuzel@sci.muni.cz) in case of updates of existing databases.

sPlot papers initiated during the 2nd sPlot Workshop

During the workshop **eight paper ideas** were identified as most promising for publication. Outlines of the respective papers were prepared in out-break groups, and suitable analytical approaches were tested with the sPlot 1.0 and TRY 2.0 dataases. Each of these paper ideas will be further prepared by a team of core authors as listed below during the next months. In the following, those Consortium members are listed by names who have already contributed to the shaping of the papers and the pre-analyses and who will continue to work on the papers during the next months. The persons who have agreed to lead the writing and who presumably will be first authors are given in bold. The author lists below are preliminary and only present the initiators who will start writing.

When the **new versions of the databases (sPlot 2.0 and TRY 3.0)** are available (presumably by the **end of February 2015**), the paper projects will be formally announced to the sPlot Consortium members at that point of time, giving all those who have contributed data by then the chance to express their interest to join as co-authors. Afterwards the analyses will be re-run with the new datasets and the papers finalised for submission. If, however, you are strongly inclined to get involved with the paper preparation already in December to February, please contact the respective first author for inclusion in the discussions and preparation among co-authors.

Abbreviations: CWM = community weighted mean; FD = functional diversity; PD = phylogenetic diversity, TD = taxonomic diversity.

Short-term papers

(Analyses and writing started during the Workshop; final analyses planned as soon as sPlot 2.0 and TRY 3.0 are released, submission during 2015 intended; 1 is the opt-out paper, all others are opt-in papers)

1. Database paper

(Describing the establishment and the content of sPlot, its match with TRY and the novel opportunities offered for ecological research through sPlot)

Jürgen Dengler, Milan Chytrý, Ute Jandt, Florian Jansen, Borja Jímenez-Alfaro, Jens Kattge, Jonathan Lenoir, Bob Peet, Valério Pillar, Oliver Purschke, Marco Schmidt, Anita Smyth, Cyrille Violle & Helge Bruelheide

(All custodians of databases included in sPlot 2.0 will automatically become co-authors = opt-out paper in the sPlot Rules)

2. Resampling methodology
(Describing the idea and the implementation of a new resampling methodology used for sPlot analyses, but also widely applicable to other ecological data)
Jonathan Lenoir, Peter van Bodegom, Milan Chytrý, Jürgen Dengler, Ute Jandt, Florian Jansen, Borja Jímenez-Alfaro, Valério Pillar & Helge Bruelheide

3. Basic pattern paper
(CWM, FD ~ climate, growing degree days, soil, fire; include multivariate ordination)
Brody Sandel, Valerio Pillar, Cyrille Violle, Richard Field, Milan Chytrý, Jürgen Dengler, Miguel Mahecha, Jens Kattge, Ute Jandt, Jonathan Lenoir, Bob Peet, Oliver Purschke, Christine Römermann, Franziska Schrodt & Helge Bruelheide

4. Functional composition and diversity ~ temporal climatic variability
(Testing conflicting hypotheses about how environmental variability in time (EVt, at multiple time scales, i.e. seasonal, inter-annual, decadal, Holocene) affects CWM, FD and PD. Does the answer flip at different scales of EVt? Does it depend on formation? Does it depend on spatial grain or extent? Does it depend on climate type (regions of climate space?)
Oliver Purschke, Jürgen Dengler, Richard Field, Jens Kattge, Jonathan Lenoir, Miguel Mahecha, Christine Römermann, Brody Sandel, Nathan Swenson, Marten Winter & Helge Bruelheide

5. Ecosystem functions (productivity, …) ~ CWM, FD, PD
(Relate remotely sensed and or modelled products of productivity and productivity change to diversity and traits in plant communities)
Miguel Mahecha, Julia Joswig, Jürgen Dengler, Jens Kattge, Valerio Pillar, Oliver Purschke, Christine Römermann, Franziska Schrodt & Helge Bruelheide

6. Invasive / alien species
(Are communities of invasive species different in terms of PD and FD in their native vs. invaded range?)
Tiffany Knight, Milan Chytrý, Jürgen Dengler, Richard Field, Bob Peet, Oliver Purschke, Brody Sandel, Anita Smyth, Marten Winter & Helge Bruelheide

7. Relationship TD, FD and PD and their spatial scaling across the world's biomes
(How are TD, FD and PD, both alpha and beta, related to each other and how does this relationship change across climatic space/biomes; a prominent approach for this paper are diversity-area curves constructed for spatial windows with a good representation of plots)
Oliver Purschke, Jon Chase, Jürgen Dengler, Richard Field, Jonathan Lenoir, Bob Peet, Brody Sandel, Nathan Swenson, Cyrille Violle, Marten Winter & Helge Bruelheide

Medium-term papers

(Paper ideas that cannot be put into practice in the near future but need further elaboration and search for suitable subsets of data in sPlot)

8. Animal distribution ~ Functional composition and beta diversity of plant communities
(Link sPlot data to animal distribution data; identify suitable subsets of sPlot for such studies; possibly focus on birds)
Hjalmar Kühl, Jürgen Dengler, Richard Field, Tiffany Knight, Cyrille Violle, Franziska Schrodt, Anita Smyth, Marten Winter

According to the sPlot Rules, each member of the sPlot Consortium has the right to **propose further papers using sPlot data**. This will be possible after the release of sPlot 2.0, i.e. likely starting in March 2015 (you will be notified). The procedure follows sPlot Rule 5c (see http://www.idiv.de/sdiv/workshops/workshops-2013/splot/materials/content_56450/sPlot-Rules_approved.pdf). The sPlot Core team will try to serve data requests from the sPlot Consortium (if complying with the Rules) in a timely manner, but please accept that we have very limited resources for preparing data outputs (this is so far only partly automatized) and data provision of the eight core papers listed above has priority.

With our best regards,

Jürgen Dengler (sPlot Coordinator), ***Oliver Purschke*** (sPlot PI) & ***Helge Bruelheide*** (sPlot PI and Chair of the sPlot Steering Committee), together with ***Milan Chytrý***, ***Jens Kattge***, ***Valério De Patta Pillar*** & ***Brody Sandel*** (all sPlot Steering Committee)

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