The TRY Initiative on Plant Traits

Meeting Report: Workshop, 25 – 27 March 2011

Maison Internationale, Cite Universitaire, Paris, France

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Status report and introduction to the workshop

The workshop was funded by the French Foundation for Biodiversity Research (FRB), GIS Climat and DIVERSITAS. The meeting was organised by Sandra Diaz, Sandra Lavorel, Jens Kattge, Colin Prentice, Paul Leadley, Heike Lischke, Hisashi Sato and George Hurtt. Paul Leadley (Chair; bioDISCOVERY) and Anne Larigauderie (DIVERSITAS) welcomed the participants on behalf of the organisers and sponsors, respectively.

TRY is a joint initiative of DIVERSITAS, IGBP, and the Max Planck Institute of Biogeochemistry (MPI-BGC). The initiative has started in 2007 and the database development has been made possible through funding by the MPI-BGC (Christian Wirth, since 2010 Susan Trumbore). Motivation for creating the TRY database was the realisation, that plant functional diversity is not adequately represented in dynamic global vegetation models (DGVMs), and that a global database providing the necessary information in terms of plant functional traits is lacking. The mission of TRY is thus to developed a global database of plant traits and make the data available to the ecological and vegetation modelling community.

In 2008, intellectual property guidelines were released. The data property remains with owners, and data exchange / acquisition is set up as a give-and-take system (people wishing to use data are expected to first submit data to the database). However, data are also being made available for modelling purposes (e.g. parameterization of models), where contribution of additional trait data cannot be expected.

The TRY database so far integrates 93 plant trait databases worldwide. It contains three million trait records, representing 1000 traits (52 "core" traits) for 70,000 species. About 50% of the trait entries are geo-referenced for about 8300 measurement sites (Figure 1). Nevertheless, at this stage, there are still considerable gaps in the trait-species-environmental matrix, which place constraints on multivariate trait analyses. Efforts are under way to identify and fill these gaps, and to provide links to community and environmental data linked to trait data submitted (see paragraph ‘Future directions of TRY’). Repeated observations (monitoring) are to be tracked by time stamps and individual identifiers.

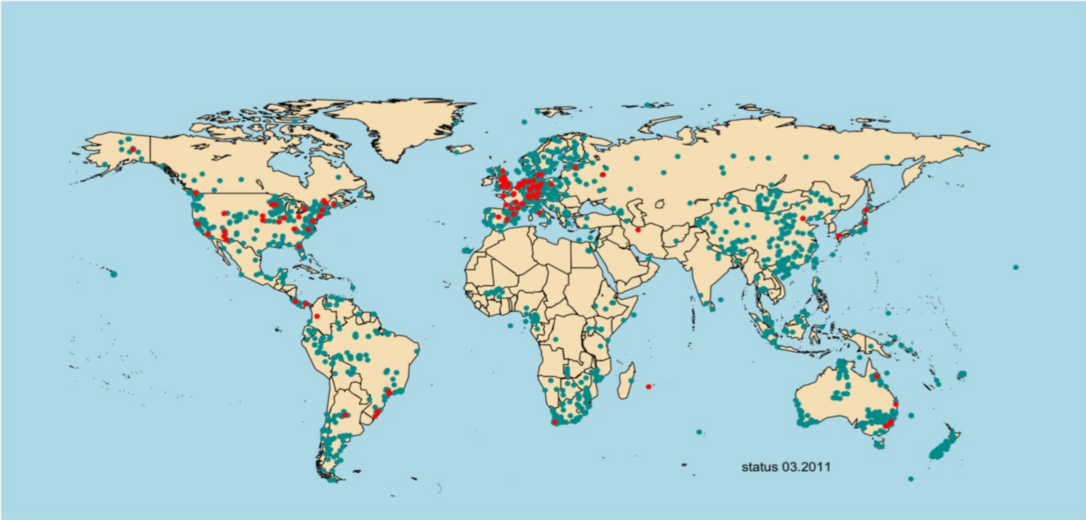

Figure 1: Geographic distribution of measurement sites (green) and partner institutes of the TRY initiative (red).

The TRY initiative has currently 198 partners from 106 scientific institutes worldwide (Figure 1) and is involved in a number of publications and research grants (Table 1): the structure of the TRY database has been published (Kattge et al., 2011); the standard reference to the TRY initiative is accepted (Kattge et al., accepted); 49 scientific proposals have requested data from the TRY database[1] and first publications using TRY as resource for plant trait data are in review.

During the last years the TRY initiative has developed several cooperations and experienced substantial support from many initiatives, for example VegFunction[2], DiverSus[3] and RAINFOR[4] with respect to integrated plant trait compilations; the Royal Botanical Gardens KEW and the OpenPlantBio consortium in the context of digitizing plant floras (and trait data); BIEN[5] in the context of botanical survey and inventory data; BBS[6] and TERRABITES[7] in the context of vegetation modelling. A first cooperation with FLUXNET[8] has been established at the workshop. The TRY initiative has an agreement of cooperation with TraitNet[9], where TraitNet serves as data portal for a network of existing trait databases, while TRY provides an integrated global database of plant traits (see http://www.try-db.org/uploads/Site/TRY_TraitNet_Coordination.pdf).

For more information on TRY and the TRY database, visit www.try-db.org.

So far, three meetings of the group were held, the first in Alicante, Spain in 2007, the second in Paris, France, in March 2008, and the third in Cape Town, South Africa, 2009, - in conjunction with the Biome Boundary Shift (BBS) initiative. Objective of this year's meeting was to take stock on finished and ongoing project activities, identify future needs and foster the development of new core research activities. Principal investigators of ongoing projects using TRY data were invited to present their projects, and (first) results.

The next meeting of the TRY initiative is foreseen for spring 2012, again in cooperation with the BBS initiative.

[1] See TRY website: http://www.try-db.org/index.php?n=Site.Projects or the internal area: http://www.try-db.org/index.php?n=Site.ProjectsTest

[2] VegFunction: ARC-NZ Research Network for Vegetation Function: http://www.vegfunction.net/

[3] DiverSus: Network for Research on Diversity and Sustainability: http://www.nucleodiversus.org/?lang=en

[4] RAINFOR: Amazon Forest Inventory Network: http://www.geog.leeds.ac.uk/projects/rainfor/

[5] BIEN: Botanical Information and Ecology Network: http://www.nceas.ucsb.edu/featured/enquist

[6] BBS: Modelling Biome Boundary Shift: http://www.jamstec.go.jp/frsgc/research/p4/GHP/2008_GLP_WS/index.html

[7] TERRABITES: The Terrestrial Biosphere in the Earth System: http://www.terrabites.net/

[8] FLUXNET: daac.ornl.gov/FLUXNET/fluxnet.shtml

[9] TraitNet: http://traitnet.ecoinformatics.org

Table 1: Publications and research grants with involvement of TRY (chronological).

Publications

- Yahara et al., 2008. Genetic diversity assessments in the century of genome science. *Current Opinions in Environmental Sustainability.*
- Brovkin, 2009. European biospheric network takes off. *EOS Newsletters.*
- Fisher, 2010. *ILEAPS Newsletters.*
- Onoda et al., 2010. Global patterns of leaf mechanical properties. *Ecology Letters*.
- Reich et al., 2010. Evidence of a general 2/3-power law of scaling of leaf nitrogen to phosphorus among major plant groups and biomes. *Proceedings of the Royal Society B.*
- Kattge et al., 2011. A generic structure for plant trait databases. *Methods in Ecology and Evolution*.
- McMahon et al., 2011. Improving assessment and modelling of climate change impacts on global terrestrial biodiversity. *Trends in Ecology and Evolution*.
- Ziehn et al., in press. Improving the predictability of global CO2 assimilation rates under climate change. *Geophysical Research Letters*.
- Kattge et al., accepted. TRY – a global database of plant traits. *Global Change Biology*.
- Gerstenlauer and Wiegand, in review. Predicting natural selection for life-history traits using stochastic matrix population models. *Methods in Ecology and Evolution*.
- He et al., in review. Relationships between net primary productivity and forest stand age in US forests. *Global Biochemical Cycles*.
- Knapp et al., in review. Phylogenetic and functional characteristics of household yard floras and their changes along an urbanization gradient. *Ecology*.

Research grants

- Refining plant functional classifications for Earth System Modelling. 2006-2009. S. Lavorel, C. Prentice, S. Diaz, P. Leadley. Funded by IGBP and DIVERSITAS.
- DIVERSUS (Network for Research on of diversity and sustainability). 2006-2012. S. Diaz, L. Poorter, B. Finegan et al.. Funded by the Interamerican Institute for Global Change Research.
- TERRABITES (Terrestrial Biosphere in the Earth System), 2010. C. Reick, V. Brovkin, P. van Bodegom, A. Arneth et al.. Funded by the European Union (EU Cost Action).
- Opportunity Knocks: Transformative Steps in Plant Data Synthesis. 2010. P.B. Reich. Funded by the University of Minnesota.
- DIVGRASS (Plant Functional Diversity in French Permanent Grassland). 2011. P. Choler, P. Leadley, S. Lavorel, E. Garnier, C. Violle, N Violle, S. Gachet, J. Kattge et al.. Funded by CESAB.
- Profiling plants to predict success and longevity of climate change-induced invasions. 2011. K. Meyer. Funded by the German Science Foundation (DFG).
- TRY 2.0 - Professionalizing the first global communal plant trait repository. In review. C. Wirth, J. Kattge. Submitted to the German Science Foundation (DFG).
- OpenPlantBio (Open Access repository and data services for Plant Biodiversity research). In review. T. Janssen, S. Sierra, W. Berendsohn, D. Kirkup, J. Kattge, C. Wirth et al.. Submitted to the European Union (FP-7).

Presentation of projects

Data oriented projects

TRY – a global database of plant traits (Jens Kattge; TRY project 2 and 3[10])

This project was meant to provide the standard reference for the TRY initiative and developed look-up tables for relevant categorical traits. The scientific part was focussed on characterizing density distributions for plant traits, a prerequisite for statistical analyses and model-data integration. Based on an unprecedented data coverage it was shown that most traits are approximately log-normally distributed, with widely differing ranges of variation across traits. Most trait variation is between species (interspecific), but significant intraspecific variation is documented. PFTs, as commonly used in vegetation models, capture a substantial fraction of the observed variation - but for several traits most variation occurs within PFTs, The manuscript is accepted at *Global Change Biology,* representing all data contributors at the time of manuscript submission (Kattge et al., accepted). In this context look-up tables for several categorical traits will be made public on the website of the TRY initiative.

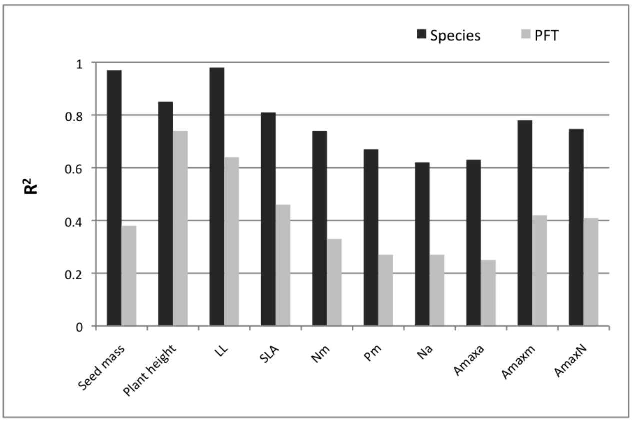

Figure 2: Fraction of variance explained by species identity resp. plant functional type for a range of plant traits (Kattge et al., accepted).

Towards a global multidimensional spectrum of plant function (Sandra Diaz; project 23)

Aim of this analysis is to describe and analyse the global multidimensional spectrum of plant trait data. There is evidence for consistent pattern in trait relationships, however, only a few of these relationships are represented at the global scale. The main aim is to identify the organising principles of all traits collected in the database. Current focus of interest are the main axes of variation, the degree of orthogonality and relative importance on a global scale, identification of traits underpinning non-orthogonality, identification of other, relevant, axes that have been neglected, and identification of consistent links between size-related and chemical composition-related traits.

Pattern of functional diversity of North American forests based on plant functional traits and abundance data (Ulrike Stahl; project 15)

The project investigates fundamental trait syndromes of North American forests, and whether they reflect growth rate and tolerance to drought and shade across temperature and precipitation gradients, with different fire disturbance regimes. 23 traits for 305 species, covering leaf, seed, stem, root and whole-plant traits were collected to obtain a comprehensive overview of traits. Overall, traits for growth and drought/shade tolerance are linked in gymnosperms, and are independent in angiosperms.

A comparison of plant phylogenetic and functional diversity across urban to rural gradients in the US and Europe (Sonja Knapp; project 8)

Aim of this study was to compare the functional trait "make-up" and phylogenetic characteristics of plant species that occur spontaneously in urban household yards and

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[10] See TRY website: http://www.try-db.org/index.php?n=Site.Projects. Or the internal area: http://www.try-db.org/index.php?n=Site.ProjectsTest

natural species (representing the major biomes in the study region, prairie grassland, coniferous forest and deciduous forest) along an urban – rural gradient. Species richness, functional composition, phylogenetic diversity and phylogenetic distinctness of plant communities were taken into consideration. Results indicated that urban yards select more exotic and less native species than the natural areas species pool, with even more exotics found there than in broader urban areas. Urban yards also select for more self-compatible and less self-incompatible species than natural species pool, as well as species with higher specific leaf area (SLA) than the natural areas species pool. Plants found in urban areas are also more closely related to each other than species in natural areas. The study thus confirmed patterns observed in other areas, with exotic species being the drivers of these patterns. A manuscript has been finished and submitted to Ecology, offering co-authorship to all respective data contributors. Two contributors accepted and got involved in finalizing the manuscript.

Simulation of grassland dynamics under global change: Parameterisation of a biogeochemical model with community-scale plant functional traits (Jean-François Soussana; project 10)

In a response-and-effect framework, the study aimed at predicting the trait-based response of species to an environment, and the contribution of the species to ecosystem function, and to confirm the shift in traits predicted under climate change. A grassland ecosystem model (PaSim) was used for the analysis, with changes in traits fixed in the model. First results using the algorithm are promising, however, there is a lack in aggregated functional data that needs to be overcome. For a next step, data on grass mixtures and monocultures from the Jena Experiment (http://www.the-jena-experiment.de) will be obtained and integrated into the model.

Modelling projects

Analysis and use of TRY data for model parameterization – ideas and progress (Koen Kramer; project 22)

In the context of the BACCARA project the climate change risks for common European tree species is being assessed, combining empirical and modelling studies at European scale. Some difficulties have been experienced in parameterizing process-based models. To circumvent this, the correlative structure at species level are derived from a large trait database, which is then used to test the model and to define and parameterise the plant functional traits. The end result of trait analysis includes a hierarchically structured parameter database, information on correlation structure of parameter values not necessarily stored at species level and searching mechanisms to take care of correlation structure. First applications of derived parameter sets in the context of the ForGEM and FORSPACE model were demonstrated.

Regional DGVM applications and the parameterization of new PFTs (Ben Poulter; project 18)

The project MTVEGMOD applies a DGVM framework to investigate global change impacts (climate and O_3 interactions) on vegetation dynamics in the Yunnan Province of China. Key issues are the appropriate representation of shrubs and grasses. Main genus of interest is *Rhododendron*, for which TRY data are being used to modify parameters in the DGVM representing shrubs. DGVMs are generally applied on a global scale, but there is an increasing need for local impact assessments, especially in diversity hotspots. TRY can - to some extent - contribute regionally specific plant traits to facilitate these assessments.

A trait-based approach to represent vegetation in DGVMs (Peter van Bodegom; project 6)

The TRICYCLE approach is based on continuous plant traits and incorporates assembly theory concepts and probabilistic features to represent plant functional types. The assembly theory links environmental conditions to plant traits, while habitat filtering only leaves those species that are adapted to a certain environment. This adaptation is reflected in traits, leading to trait convergence. The assembly theory can be applied at global scales by approximating environmental drivers such as nitrogen assimilation, or water stress. Global trait maps are derived based on environmental (climate-soil) predictors. In a second step, probabilistic features are taking into account to move from environmental conditions to functional traits to plant functional types / vegetation structure / biomes. For each position in trait space, multiple biomes may in principle be possible, and the probability of each is described by Gaussian kernels. Vegetation type predictions are solely based on functional traits and assembly theory, and a similar probability for different trait combinations in certain area might indicate functional equivalence of biomes. If bioclimatic constraints are included, some of the similar probabilities are eliminated, indicating that climatic constraints are necessary to distinguish between biomes.

Linking decomposability of leaf litter and dead wood to their traits: a global analysis of woody species (Christian Wirth; project 16)

A trait-based approached to relate wood- to leaf-decomposability has been developed to determine whether decomposability is a whole-plant feature. Slow conservative versus fast, acquisitive species could be identified, however, decomposition predictors are located on 2 orthogonal axes. As decomposition itself is not a trait, but an ecosystem process, which is highly sensitive to environmental variables, these need to be controlled for in the analysis, and linked to traits that predict decomposability. Trait variables for the leaf economic spectrum (LES) and wood economic spectrum (WES) were regarded in the analysis. Preliminary results show that gymnosperms have different decomposability than angiosperms, and a strong phylogenetic signal can be detected. In angiosperms, no relationship could be observed between LES and WES in decomposability. Other variables that influence decomposition, and should be included in further studies include leaf litter variables (e.g. packing, moisture content), as well as secondary leaf compounds.

P-Cycle: adding a phosphorus cycle to the terrestrial vegetation model JSBACH (Daniel Goll; project 13)

The carbon sequestration as predicted by DGVMs for the 21st century is criticized as being to high, as most models neglect nitrogen (N) and phosphorus (P) limitation. Aim of this project is to add a P cycle to JSBACH, a DGVM already including an N cycle. The stoichiometry of C:N:P in the different plant pools (leaves, wood and litter, provided by TRY data) is used to derive P and N flux from C flux. Four carbon uptake scenarios are considered: C only, C+N, C+P, and C+N+P. The modelled nutrient limitation matches observed outputs (Wang et al 2010, Biogeosciences). Overall, this is the first transient C cycle projection accounting for N and P availability. P and N limitation add up, and P mineralisation is partly uncoupled from temperature. It appears that the long-term evolution of the land sink is strongly affected by P availability.

Integration of plant trait data into vegetation models

Key Notes

DGVMs – A new plant trait approach (Colin Prentice, Ian Wright)

Although there has been an explosion of information, yet today's DGVMS still reflect late-1980s knowledge, and most results are obsolete for the processes represented in DGVMs. Mechanistic models reflect the underlying processes best, but might not be the only approach. Rather, it would be preferable to combine this with optimality based modelling that is applicable to many processes, and work with robust approximations. To improve the current generation of models, both observation and experimental results need to guide model construction and model evaluation. This can be achieved by using new theory, and new compilations of plant-level (trait) observations to provide bottom-up constraints on models, in combination with earth system observations to provide top-down constraints at ecosystem to global scales, e.g iLAMB, coupled with the development of bench mark data sets.

Leaf trait based improvements to CLM4.0 canopy physiology and optimization approaches to modelling leaf area (Rosie Fisher)

The CLM (Community Land Model) has recently been improved by e.g. altering the radiation code and co-limitation of photosynthesis, (Bonan et al in press). However, the new model still overestimates LAI. To counteract this, further modifications have being introduced, including 1) a multi-layer canopy, 2) trait based parameterization of photosynthetic capacity according to Kattge et al. (2009), 3) respiratory acclimation, 4) data-derived leaf economics and 5) respiration changes Finally model outputs correspond better to observations, e.g. LAI. In conclusion, considerable improvements can be made to the CLM canopy physiology by using global leaf trait analyses. Further steps will include a global respiration analysis, inclusion of transient leaf behaviour and N limitations, entraining newer TRY data for PFT parameters, optimisation of carbon and nitrogen allocation, and inclusion of ecosystem demography. Biome shift work will include the incorporation of migration in CLM in collaboration with MIT.

Open discussion on the integration of plant trait data into vegetation models

A clear dichotomy has been observed – on the one hand, there is a need for extra massing of data (all traits in general, but especially several of those that are necessary for modellers, but not well covered yet), on the other hand access to processed data is required (e.g. to derive specific parameters, and/or abundance weighted characteristics on ecosystem level). There is also some divide between trait ecologists and vegetation modellers.

The modelling community is invited to set up a list of core characteristics (e.g. model parameters or state variables for model evaluation) related to plant traits that are / or will be commonly required in current and future vegetation models. This will be another way to identify gaps in the database - as the current list of core traits in TRY has been developed by plant ecologists. In addition, covariates that are of importance and should be measured need to be identified. An application-driven approach is encouraged, as there are much more trait data out there, which could potentially be compiled. If the trait community would be better informed about the requirements of the modelling community, people likely to have collected respective traits can be approached, or trait data can be collected. Such a “trait wish list” however, will always be under revision, as more and more processes are included in models, and more traits are going to be required. This process, though, will keep TRY going.

Vegetation models often require abundance-weighted characteristics, either based on species occurrence or biomass. TRY itself does not systematically compile species distribution, inventory or biomass data; e.g. TRY does only compile biomass data in the context of calculating biomass-ratios, indicating biomass allocation trade-offs. TRY will rather facilitate links to respective databases and projects. A first step will be a link from TRY to the BIEN project. BIEN combines distribution, abundance and trait data for the Americas. Such a product, on global scale, could be of most use to the modelling community (and to the monitoring / assessment community). A larger project, covering the globe, could be put together under the auspices of GEO BON.

As a number modelling groups already use TRY data, some of the core relationships between traits and processed data could be fine-tuned between different modelling groups and be fed back into the TRY database.

The large numbers of different characteristics / traits contained in the TRY database makes the dataset difficult to use. Eric Garnier, in cooperation with TraitNet and TRY, is developing a thesaurus for plant traits, which will help to better identify the different traits (see Future directions of TRY).

Three steps to improve TRY from a modelling perspective:

- Develop a modeller’s wish list for core plant traits and systematically add data for those not sufficiently covered yet.
- Improve trait data processing to better meet model requirements.
- Feed back derived processed data into the TRY database, including all meta-data and processing protocols.

Communication between vegetation modellers and plant trait ecologists could be improved by small, focussed workshops in the context of bioDISCOVERY or TERRABITES.

Break-out groups

(1) Plant traits and ecosystem function

Peter van Bodegom, Markus Reichstein, Jens Kattge, Pete Manning, Sonja Knapp, Kirsten Thonike, Gerhard Bönisch, Daniel Laughlin, Michael Bahn, Jean-Francois Soussana, Paul Leadley, Peter Reich.

This break-out group is focusing on, but not limited to TRY and FLUXNET.

FLUXNET is a global network of micro-meteorological tower sites that use eddy covariance methods to measure the exchanges of carbon dioxide, water vapour, and energy between terrestrial ecosystems and the atmosphere. More that 500 tower sites from about 30 regional networks across five continents are currently operating on a long-term basis.

The exchanges of carbon dioxide, water vapour, and energy measured by eddy covariance methods are emergent properties of the ecosystem - the interplay of soil and vegetation (and in some cases also macro-fauna). Plant trait data are required to link the observed ecosystem functions and properties to plant function and diversity: Is there an effect of plant functional diversity on ecosystem functions and properties (a) between sites and (b) within? Eddy covariance measurements provide the opportunity of moving beyond "static" measures of ecosystem function like peak biomass towards using dynamic measurements, like GPP, or drought sensitivity to determine the importance of functional diversity in controlling ecosystem function. Nevertheless, about 80% of flux variation can already be explained by environmental variables and - in addition - plant traits are correlated with the environmental conditions.

Aim of this break-group was to develop approaches how to link the FLUXNET dataset with the TRY dataset on plant trait data, to identify the contribution of plant traits to ecosystem fluxes and function. We expect that process oriented models will contribute to the analyses, but will not be the only way to address the relationship of plant traits and ecosystem function. A first workshop was suggested to be held in the context of the TERRABITES EU project to check statistical versus process oriented approaches. It was agreed to start the analyses for rather 'simple' systems: separating forest and grassland sites and selecting sites with one (few) dominant species. Proposals will be submitted to FLUXNET and TRY for permission to use the respective data. Jens Kattge, Peter van Bodegom, Jean-Francois Soussana and Markus Reichstein will take lead on this initiative.

The initiative still welcomes participants. In case of interest, please contact Jens Kattge, Peter van Bodegom, Jean-Francois Soussana or Markus Reichstein.

Break-out group 2: Intra-specific variation of traits

Basis for this break-out group is a proposal aimed at determining the plasticity of plant traits, and detection of global trends in plasticity. The proposal is built upon two aspects reported in the TRY standard reference (Kattge et al. accepted): (1) there is considerable difference between traits with respect to the fraction of variance explained by species identity (Figure 3), and (2) there is a typical range of variation within species for a given trait as soon as sufficient trait entries per species are available (Figure 3). Preliminary analysis of the TRY database has shown that for about 100 traits there are several species with sufficient number of trait entries to be used for this analysis. Aim of the break-out group was to discuss how to further the proposal and forge collaborations to explore other interesting aspects of the topic.

In order to detect a global pattern in intra-specific variability in traits, first the level of variability for each trait will be determined, and then the fraction of variation explained by species identity will be calculated (only for very well represented traits). The emphasis will be placed on the relationships between traits by clustering.

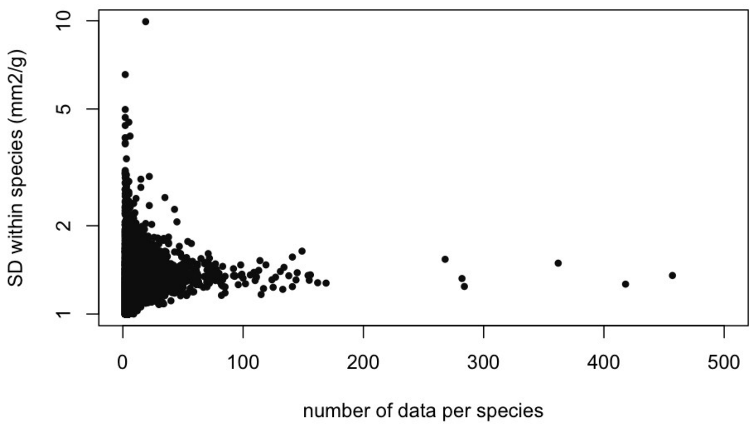

Figure 3: Relationship between standard deviation (SD) of SLA (leaf area per leaf dry mass) within species in relation to the number of observations per species (Kattge et al., accepted).

Results for the different traits might be affected by availability of species data per life form, incomplete coverage of species' geographical distributions and sampling protocols. To overcome this, only traits with sufficient species data availability should be included in the analysis, and the results verified on species with complete geographical coverage. Data points per species may be increased by contacting data providers and requesting individual measurements in cases where aggregated data had been contributed to TRY.

The initiative still welcomes participants. In case of interest please contact Nadia Soudzilovskaia (nadia.soudzilovskaia@falw.vu.nl).

Break-out group 3: Identification of a global multidimensional spectrum of plant function

Aim of this analysis is to describe and analyse a global spectrum of plant trait data, with the main aim to identify the first organising principles of all traits collected in the TRY database (see also presentation by Sandra Diaz).

A null model, based on biophysical constraints, has been developed, likely describing a maximum trait space. Six fundamental traits from different aspects of plant function (for as many species as available were used to determine the statistical and causal relationships between traits (e.g. PCA and SEM analyses).

Preliminary analysis showed that the multi-dimensional trait space occupied by plants is significantly constrained compared to the null model. Several options to further analyse the trait space have been discussed.

Future directions of TRY

Presentations by invited speakers mapped out ways how TRY could contribute or integrate with other efforts to add even more value to the database.

TRY 2.0 (Jens Kattge, Christian Wirth, Gerhard Bönisch)

The TRY web interface will be professionalised with the aims to 1) facilitate online queries and visualisation (also some of the trait data will become available in the public domain), and 2) facilitate smooth handling of the editorial process from proposal submission to data release. The “new” web interface is expected to be available online by early 2012. In order to achieve this, a proposal has been submitted to the DFG (see Table 1). Increasing use of data in the TRY database is expected to lead to further growth through a snowball effect in the near future. This, however, means that a funding for a small team needs to be acquired to keep up with demands for data, and upkeep of the data and database. In the long-term, it is envisaged that most of data contained in the database will be shifted to the public domain.

Quantifying and Scaling Global Plant Trait Diversity (Peter Reich)

This is a joint effort of the University of Minnesota and the MPI-BGC, which aims to complement the TRY species versus trait matrix by using scalable multi-variate analysis techniques that make use of the inherent covariance structure of plant traits to fill in missing data. For this, a new suite of gap-filling methods that have been developed in the context of computer science and statistics will be applied to ecology. These methods will be applicable beyond the context of the TRY data set. Predicted trait data (including uncertainties) will be available to the TRY / and ecological community, thus facilitating e.g. multidimensional trait analyses beyond current state. The efforts will further also contribute to characterising global pattern of key plant traits by combining the complemented TRY data with e.g. species occurrence/abundance or/and remote sensing data.

Plant Trait Ontology (Eric Garnier)

There is clear need to better define terms used for traits, as the same term, e.g. height is used to describe as well plant height as canopy height. Therefore, an effort has been started by the CNRS Centre d'Ecologie Fonctionnelle et Evolutive, Montpellier, to develop a thesaurus of plant traits, in cooperation with TraitNet and TRY. Thesauform, a web tool dedicated to terminological aspects of trait research, has been tested wit a group of 25 experts of the plant trait domain. Thesauform allows users to interact to verify the relevance and definition of a term used, and has an interface for validation, that will allow the group of experts to finally decide on the terms suggested for a trait. The thesaurus will also allow to develop standards for other fields of research where this is required. Next steps include making the thesaurus available via a web interface and publication; annotation of trait databases; and the use of the thesaurus as a basis for PLATON, a PLAant Trait ONtology.

OpenPlantBio (Don Kirkup)

OpenPlantBio is a consortium of European plant taxonomists (data providing partners and software providing partners) including plant trait ecologists (e.g. Christian Wirth, Jens Kattge). The consortium aims at combining biodiversity information so far published in the context of plant floras in one web portal. The portal will be a distributed repository of resources, covering the Floras of Europe, Africa and S-E Asia, as well as some floras of the New World and other areas. Information on plant traits, which will be extracted during the process of digitizing the plant floras will be made available in the context of TRY.

BIEN: (Cyrille Violle)

The Botanical Information and ecology Network (BIEN) has brought together leading collectors and managers of botanical survey and inventory data, informaticians and ecologists doing synthetic research across scales. BIEN, for the first time, integrates most of the existing sets of vegetation data spanning North and South America. This effort incorporates database resources for plant plot information and taxonomies and encompasses several million records of species occurrences. It is foreseen to link BIEN and TRY: a common BIEN-TRY project, focussing on life forms, has been established (TRY proposal 44), and a link between the web interfaces is planned for BIEN 3.0 and TRY 2.0.

Refining the TRY Intellectual Property Guidelines

The TRY intellectual property guidelines were expanded to provide quality control for the data. A statement on the philosophy behind the sharing of TRY data was included, and the guidelines on sharing and data availability were edited. The Sonja Knapp's project is an excellent example how data sharing should be implemented from the proposal stage to final paper. Data contributors were contacted to encourage collaboration, information about data used was sent, and co-authorship of the manuscript was offered. The exchange between data providers and data users gives the providers an indication how much of the data requested was actually used, and for which reasons.

It was suggested to use a more generic formulation of intellectual property guidelines for the TRY initiative, based on common formulations. Nevertheless, this needs to be carefully evaluated and may be discussed in detail at the next TRY meeting.

Refinements of the Intellectual Property Guidelines in bullet points:

- The “give and take system” as currently established in the TRY Intellectual Property Guidelines has been confirmed.
- TRY will additionally offer the opportunity to make trait data public available via the TRY web site. So far data availability was restricted to approved proposals. The guidelines have been expanded to allow for data release without the proposal being approved. Nevertheless submission of a proposal and acceptance of intellectual property guidelines will be requested.
- Look-up tables for categorical traits will be made public available without need for the submission of a proposal. The data will be free for use, nevertheless redistribution will be prohibited. The website of the TRY initiative shall be cited (resp. acknowledged) as source of the data.
- It has been suggested to establish a board of data-curators with experts from different aspects of plant trait research. The members of this board shall supervise data cleaning (e.g. matching of different concepts, standardization, detection of outliers) for the respective traits. A modus of operandi will be worked out by the TRY steering committee and experts will be invited to join the board. The modus of operandi will be introduced into the Intellectual Property Guidelines at the next TRY meeting and members of the board of data-curators approved.
- Data sharing within TRY shall be supported from submission of proposal to final paper. So far templates exist for the submission of proposals and request of permission to use the data. Additional templates will be developed to support the interaction at the stage of manuscript preparation and submission. These templates will be based on first positive experience in the context of TRY project 9, headed by Sonja Knapp (see table 1 and TRY website).

The latest version of the guidelines is circulated with the minutes of this meeting, and will be made available on the TRY and bioDISCOVERY websites.

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