

COBECORE activities at the Botanic Garden Meise

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Gent, 6 maart 2017



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Aims

- “to provide specific leaf area, stomatal density parameters and leaf nitrogen and carbon content (traits) which are important parameters in ecosystem models and indicators of adaptation to climate change in their own right”
- “cross-link this data with ... data collected during the COBIMFO,... Jungle Rhythms,... BIOSPHERETRAITS.”
- “proper data integration into a database structure and dissemination through a web portal and outreach towards the scientific community, the public and the private sector.”



Functional traits

Functional traits are defined as morpho-physio-phenological traits which impact fitness indirectly via their effects on growth, reproduction and survival, the three components of individual performance (Diaz et al. 2013).

Functional traits are morphological, biochemical, physiological, structural, phenological, or behavioral characteristics that are expressed in phenotypes of individual organisms and are considered relevant to the response of such organisms to the environment and/or their effects on ecosystem properties (Violle et al. 2007).

e.g.

- wood density
- specific leaf area
- seed size
- stomatal density
- maximum height



Plant functional trait data can provide insight in global climate change

New Phytol. (1995), 131, 311–327

The influence of CO₂ concentration on stomatal density

BY F. I. WOODWARD¹ AND C. K. KELLY²

American Journal of Botany 96(10): 1779–1786. 2009.

LONG-TERM RELATIONSHIPS AMONG ATMOSPHERIC CO₂, STOMATA, AND INTRINSIC WATER USE EFFICIENCY IN INDIVIDUAL TREES¹

ABRAHAM J. MILLER-RUSHING,² RICHARD B. PRIMACK, PAMELA H. TEMPLER, SARAH RATHBONE, AND SHARDA MUKUNDA

nature
ecology & evolution

ARTICLES

PUBLISHED: 18 APRIL 2017 | VOLUME: 1 | ARTICLE NUMBER: 0132

Functional trait diversity maximizes ecosystem multifunctionality

Nicolas Gross^{1,2,3†*}, Yoann Le Bagousse-Pinguet^{1†*}, Pierre Liancourt^{4†*}, Miguel Berdugo¹, Nicholas J. Gotelli⁵ and Fernando T. Maestre¹

Functional traits predict relationship between plant abundance dynamic and long-term climate warming

Nadejda A. Soudzilovskaya^{a,1}, Tatiana G. Elumeeva^b, Vladimir G. Onipchenko^b, Islam I. Shidakov^c, Fatima S. Salpagarova^d, Anzor B. Khubiev^d, Dzhamal K. Tekeev^c, and Johannes H. C. Cornelissen^a

^aSystems Ecology Department, Vrije Universiteit Amsterdam, 1081 HV, Amsterdam, The Netherlands; ^bDepartment of Geobotany, Moscow State University, Moscow 119991, Russia; ^cTeberda State Reserve, Teberda 369210, Russia; and ^dDepartment of Biology and Chemistry, Karachai-Cherkessian Aliev University, Karachaevsk 369200, Russia



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PNAS

Edited by Monica G. Turner, University of Wisconsin, Madison, WI, and approved September 12, 2013 (received for review June 6, 2013)

Functional trait databases



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Where am I? > Home > Kew Databases > Seed Information Database

Seed Information Database — SID

(release 7.1, May 2008)

SID is a compilation of seed biological trait data from the MSBP's own collections and from other published and unpublished sources. Its primary purpose is as an internal source of a variety of seed biological information, for use in large scale analysis and decision support for seed conservation operations.

Citing SID

Search the Seed Information Database

APG Clade

APG Order

Family

Genus

Species

Storage Behaviour (All)

Only find records with data on:

Storage Behaviour Weight Dispersal Germination

Oil Content Protein Content Morphology Salt Tolerance

Reset Search

Seed Information Database

What's new in SID release

7.1?

About the database

Current Modules

► Storage Behaviour

► Seed Weights

► Seed Dispersal

► Germination

► Seed Oil Content

► Seed Protein Content

► Plant Life-form

► Seed Morphology (incl. images)

► Salt Tolerance

► Seed Viability Constants

Tips for searching the database

Search the Database

Citing the Database

Coming Soon

Useful Links

Feedback

Potential Collaborations



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Functional trait databases

The screenshot shows the TRY Plant Trait Database homepage. At the top, there's a banner with the TRY logo and a green leafy background. Below the banner, the title "Plant Trait Database" is prominently displayed. A small image of a yellow flower is on the right, with the caption "Kempton's Starwort 17 traits Photo by A. Caudle". Below the title, there's a navigation bar with links: Home, About TRY, Data Portal, Feedback, and Registration.

Quantifying and scaling global plant trait diversity

TRY is a network of vegetation scientists headed by Future Earth and the Max Planck Institute for Biogeochemistry, providing a global archive of curated plant traits. The TRY database is a research platform of iDiv.

Database Version 4 online (2017-07-20)

6.9 million trait records
148,000 plant taxa
largely open access

Data Portal

A central column lists various plant traits: PhotosyntheticPathway, Respiration, LeafArea, NfixationCapacity, SLA, RegenerationCapacity, PlantLifespan, GrowthForm, WoodDensity, PhenologyType, LeafN, LeafP, LeafLongevity, PhotosyntheticCapacity, MaxPlantHeight, SeedMass.

News

Paper published (2017-10-09)
Borgå et al.: Plant community structure and nitrogen inputs modulate the climate signal on leaf traits. ([link](#))

Activity Report (2017-10-02)
In August and September 2017, TRY received 259 (94, 164) requests and released 10.6 (5.5, 5.1) million trait records for 185 (79, 106) requests; 8 new publications were reported. This brings the totals to 3680 received requests, 302 million trait records released for 2890 requests, and 143 recorded publications. ([link](#))

Paper published (2017-09-03)
Kaarisjärvi et al.: Herbivores rescue diversity in warming tundra by modulating trait-dependent species losses and gains; *Nature Communications* ([link](#))

Paper published (2017-09-03)
Li et al.: Planting accelerates restoration of tropical forest but assembly mechanisms appear insensitive to initial composition. *J Appl Ecol.* ([link](#))

Paper published (2017-09-04)
Uyttenbroek et al.: Increasing plant functional diversity is not the key for supporting pollinators in wildflower strips. *Agriculture, Ecosystems & Environment* ([link](#))

News Archive

Follow TRY [Facebook](#) [Twitter](#)

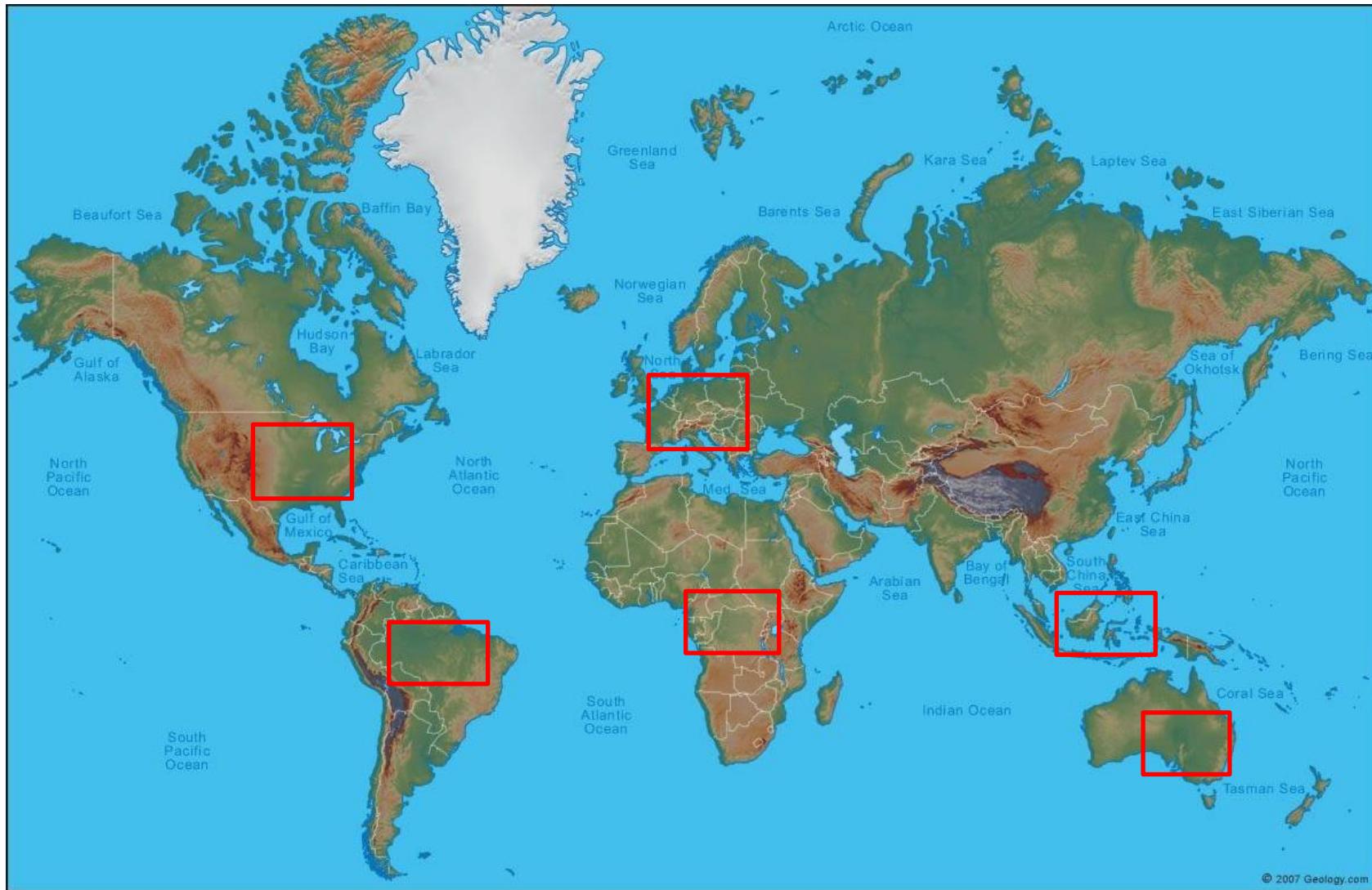
Logos for Biodiversity, Global IGBP Change, futurearth, iDiv, Max Planck Institute for Biogeochemistry, CLIMATE, FRB, and FRB.

Disclaimer | Page calls: 250727 | Gerhard Beierach, Jens Kattge, created 2012-01-11, modified 2017-08-16



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Plant functional trait data in different regions



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Plant functional trait data from central Africa missing

Data in TRY database

	Measurements
Tropical South America	366629
Central Europe	254132
North America	83374
Tropical SE Asia	53632
Australia	29776
Tropical Africa	14675

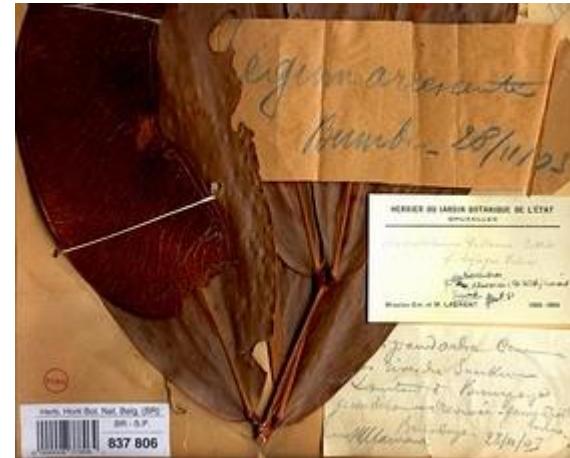
	Species
Central Europe	2846
Tropical South America	2615
Tropical SE Asia	1535
North America	1264
Australia	796
Tropical Africa	616



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Herbarium Meise: A functional trait treasure

- The *Herbarium Belgii* contains 300,000 specimens from Belgium and Luxembourg
- The *Herbarium Africanum*: about 1 million specimens from Sub-Saharan Africa (cfr. National Herbarium Yangambi)
- About 1 million specimens from the rest of the world



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Herbarium Meise: A functional trait treasure unlocked

1,2 miljoen gedroogde planten worden zeer voorzichtig ingescand

Plantentuin digitaliseert onvervangbare collectie

01/06/2016 om 05:52 door JORIS HERPOL - [Print](#) - [Corrigeren](#)



■ Minister Philippe Muyters en bioloog Koen Es scanden de eerste stuks. (FOTO: JHP)

Source: [nieuwsblad.be](#)



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Herbarium Meise: A functional trait treasure unlocked

botanical-collections-prd.appspot.com/#/en/search doe project meise EN | NL | FR | DE

Botanical collections

Home | Search | References

CLEAR FILTERS

Type anything...

977.299 results found DOWNLOAD

Name	Collection	Collector	Family	Country	Date
× <i>Bidens dimidiata</i> BR0000005261642	20509	Degener, Otto	Compositae		1950-02-07
× <i>Bolleo-chondrorhyncha froebeliana</i> BR0000013052553	S.N.	Otto Froebel	Orchidaceae		s.d.
× <i>Cirsium inerme</i> subsp. <i>belgicum</i> BR0000011685715	S.N.	Busschot A.	Compositae		1885-07-16
× <i>Crataegomespilus</i> sp. BR0000005181193			Rosaceae		s.d.
× <i>Dactylodenia lawalreei</i> BR0000006571757	18105	Lawalrée A.	Orchidaceae		1973-06-16
× <i>Dactylodenia toussaintiorum</i> BR0000006571382	1987/21	Gathoye J.L. & Tyteca D.	Orchidaceae		1987-06-16
× <i>Festulolum loliaceum</i> BR0000025296716	S.N.	VDB	Gramineae		1864-06
× <i>Festulolum loliaceum</i> BR0000012195770	S.N.	Sonnet E.	Gramineae		s.d.
× <i>Garcinia mangostana</i> BR6102004106321	1036	Léonard A.	Guttiferae		s.d.
× <i>Garcinia mangostana</i> BR6102004106320	296	Léonard A.	Guttiferae		s.d.

CLEAR FILTERS

Type anything...

977.299 results found DOWNLOAD



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What kind of (trait) data can be extracted?

- Extract plant functional trait data from herbarium specimens
 - Stomatal density
 - Specific leaf area
 - Leaf size
 - Leaf morphology
 - N content
 - Isotopes composition
- Databasing information on herbarium labels
 - Geo-referencing
 - Sample date
 - Additional information



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Research driven sampling strategy

- Temporal variation in leaf traits (BIOSPHERETRAITS)
- Spatial variation in leaf traits (HERBAXYLAREDD)
 - Species level
 - Population level
- Evolution and distribution of plant functional traits in tropical taxa (HERBAXYLAREDD)
- Community structure (COBIMFO)



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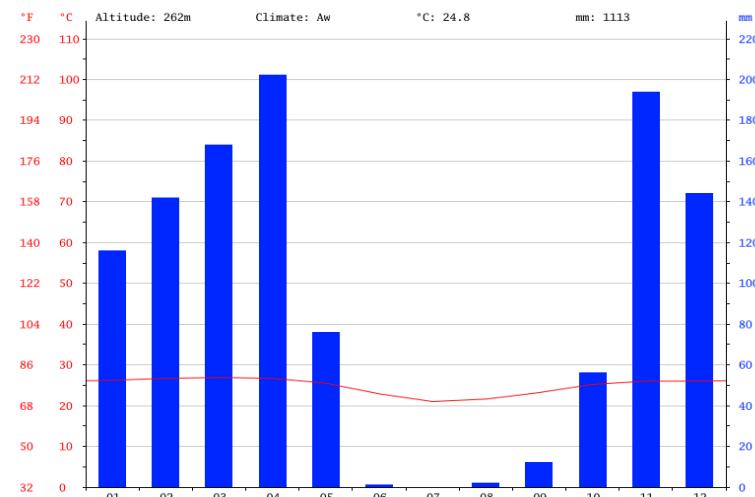
Spatial variation in leaf traits on the species level

- Focus on two sites

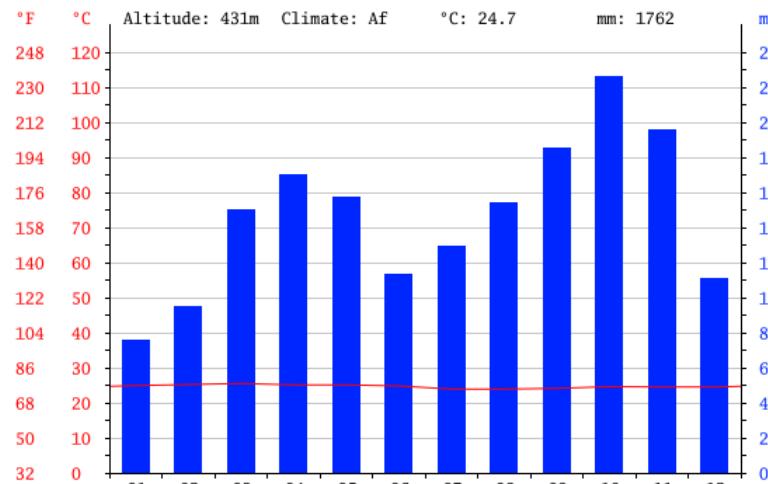
Adaptation to drought in evergreen species:

- Small leaf size
- Lower Specific Leaf Area
- Lower stomatal density
- Small vessels
- High stem density

Luki



Yangambi



Spatial variation in leaf traits on the species level

Goal:

Pairwise comparison of leaf functional traits from 68 dominant tree species occurring at both sites

Methodology

- Five specimens per species and region of origin to be selected
- For each specimen five leaves to be weighed, scanned and surface area determined
- Stomatal density will be measured on three sites per leaf

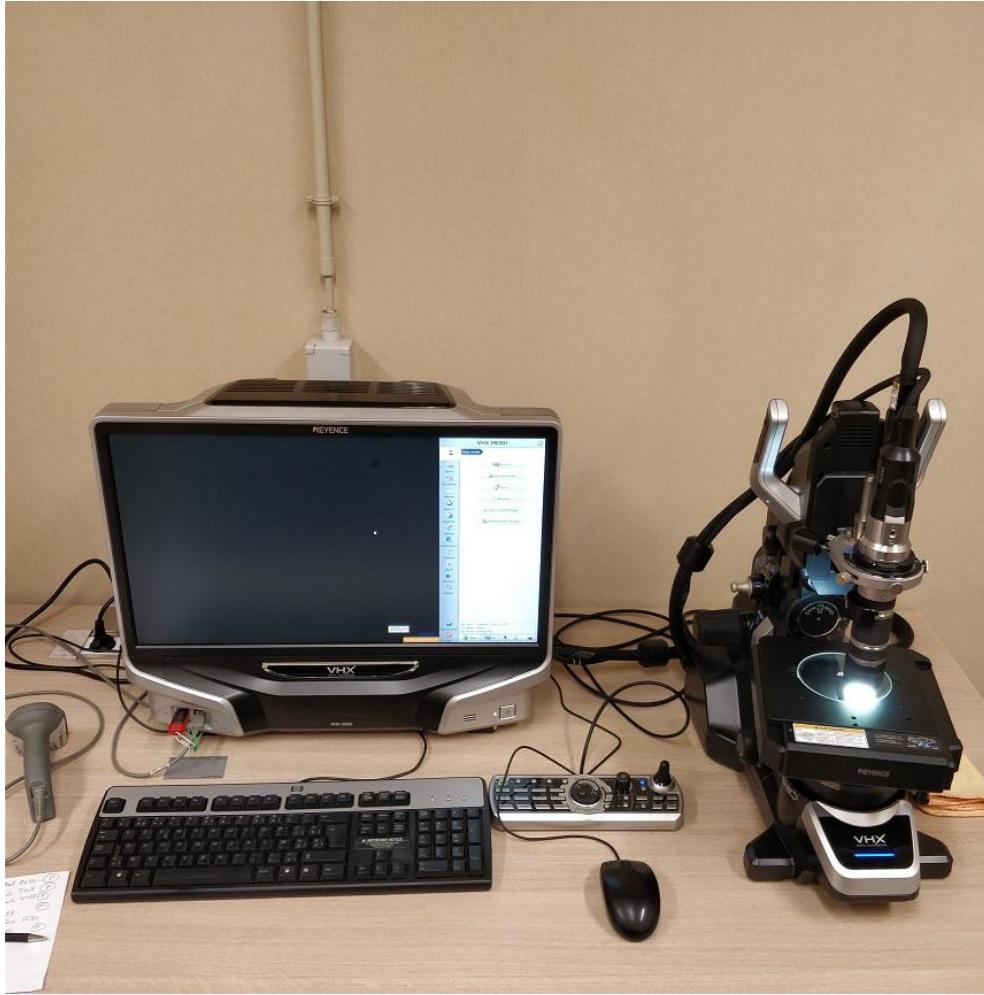


Prioria oxyphylla



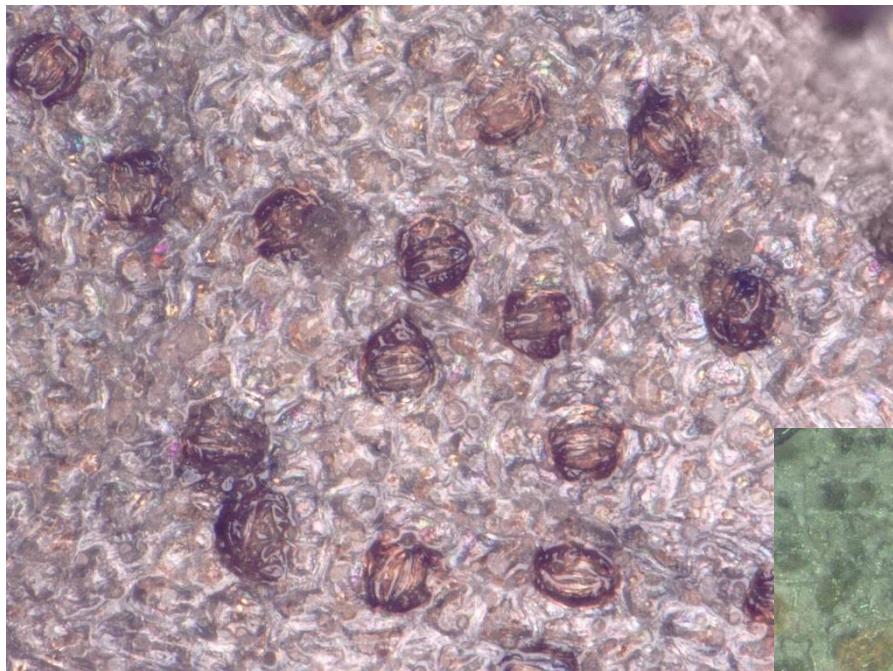
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Keyence VHX Digital microscope: imaging stomata



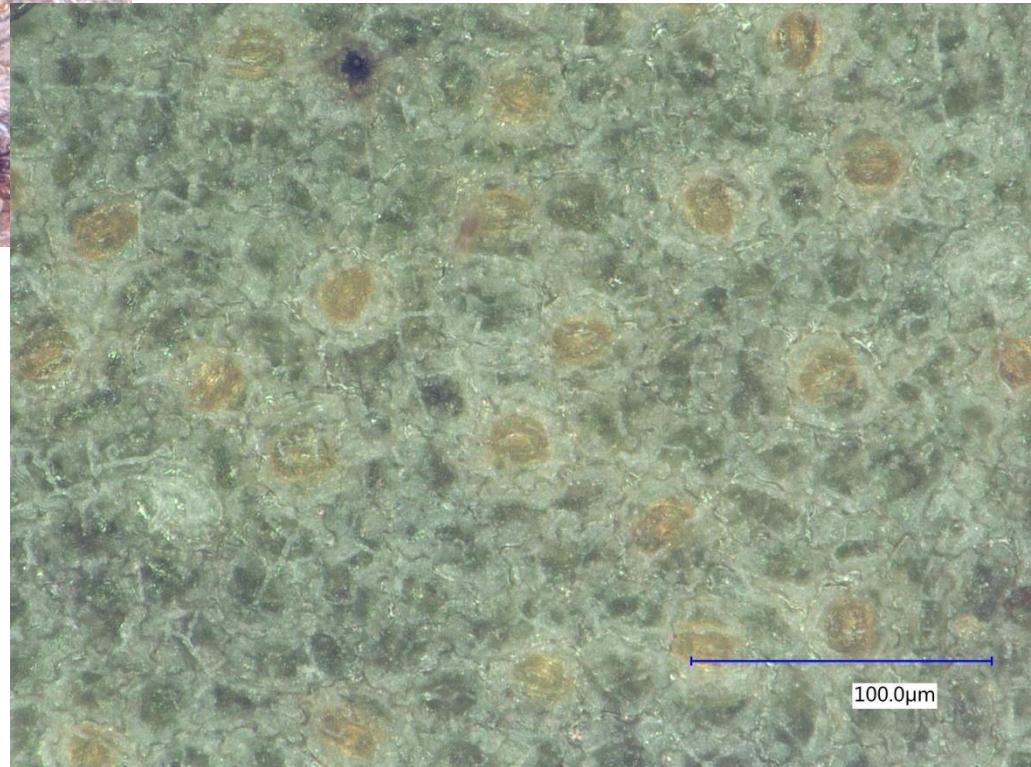
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Keyence VHX Digital microscope: imaging stomata



About 10 specimens and 150 pictures day⁻¹

Stomata counts: crowdsourcing



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Data already extracted in the framework of COBECORE

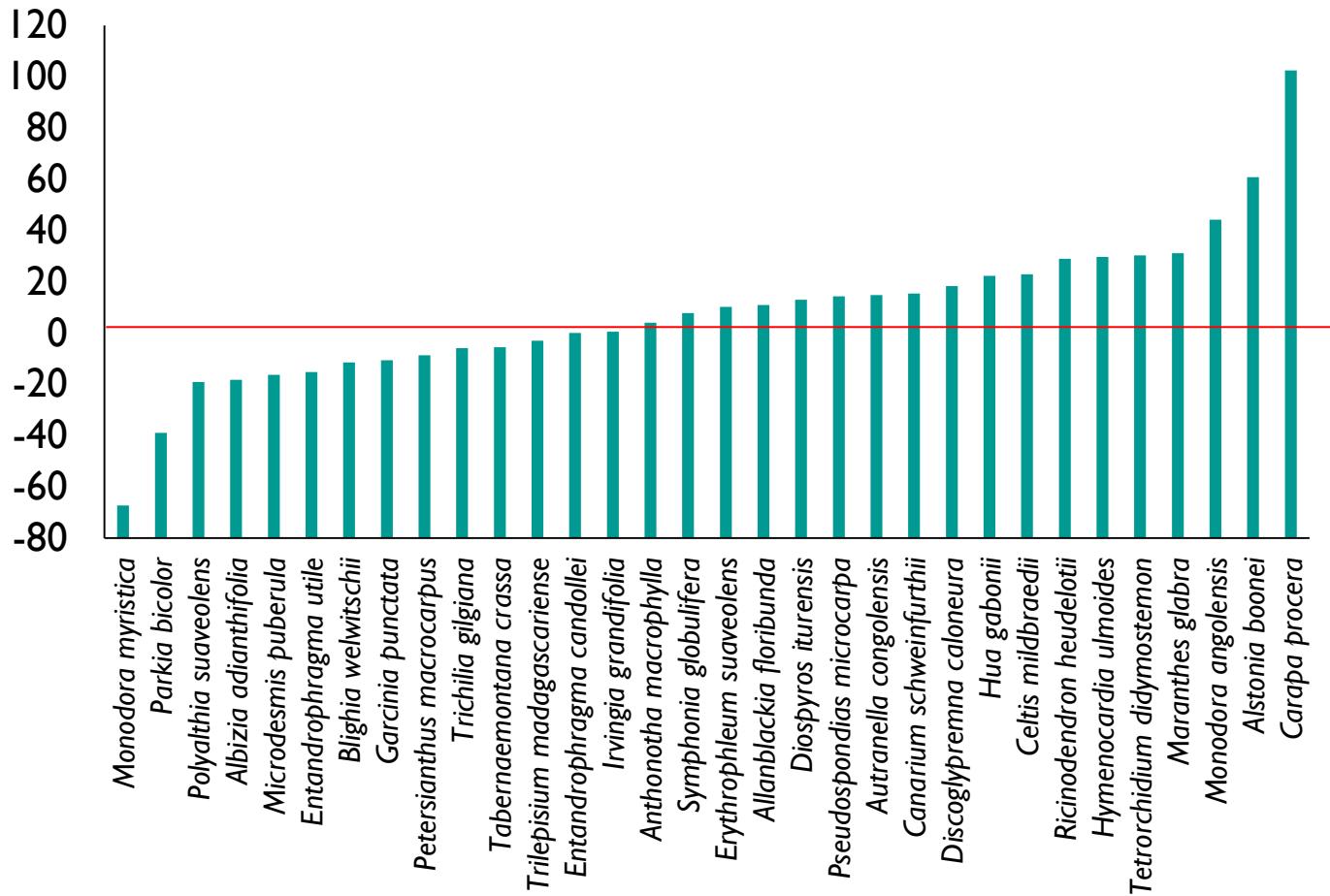
- Surface area and leaf weight for a total of 240 specimens of 48 tropical tree species
- Pictures for stomata counts were taken for 41 specimens (over 600 pictures)
- Surface area and leaf weight and pictures of stomata for over 100 specimens each of *Prioria* sp. and *Staudtia* sp.



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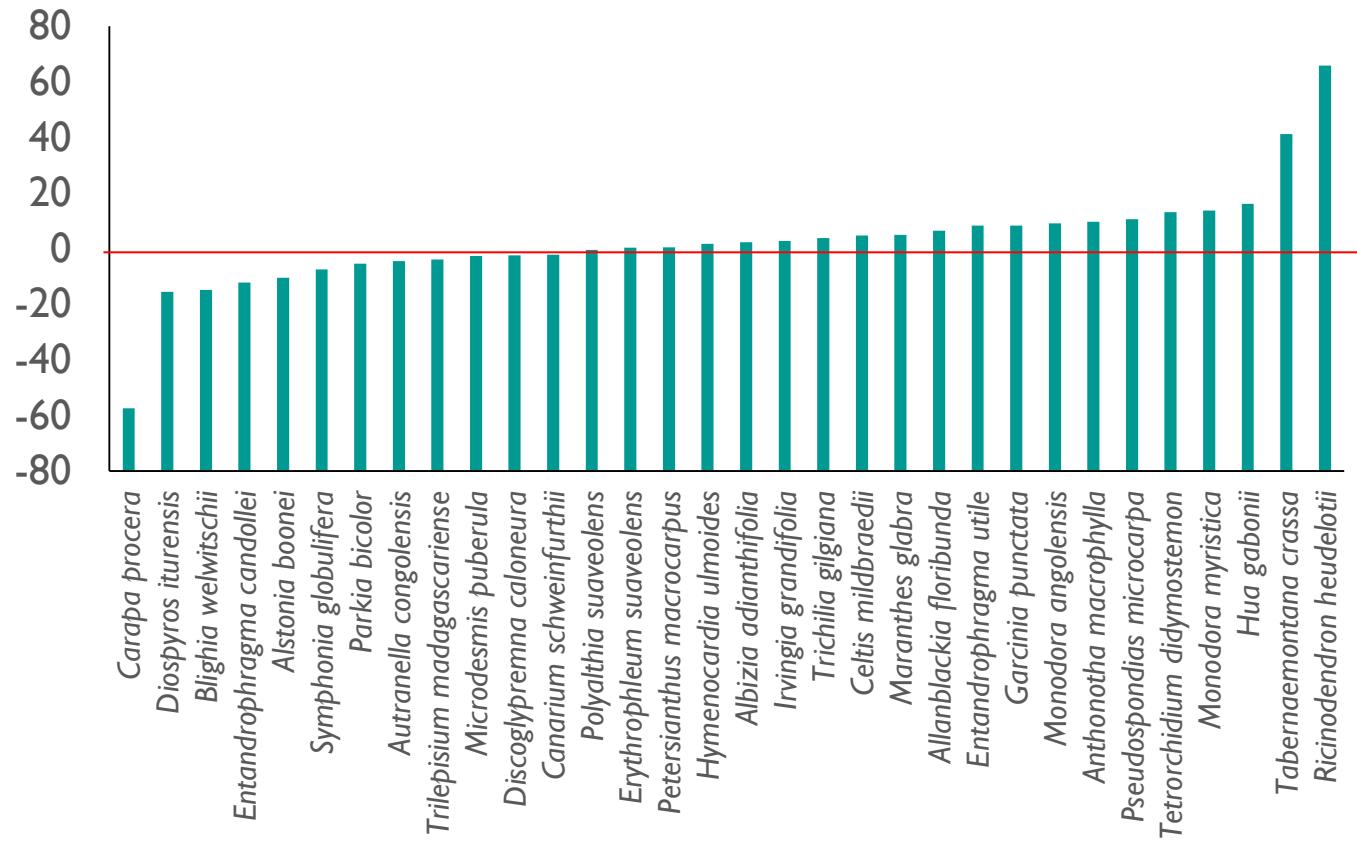
Preliminary results

SLA [Luki]-SLA [Yangambi]



Preliminary results

Leaf Area [Luki] - Leaf Area [Yangambi]



Prospects

- Increased trait sampling efforts: New group member Dr. Sofie Meeus and volunteers
- Set-up a crowd sourcing platform
- Explore possibilities to measure other leaf traits
- Analyses and writing-up of results



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