



Synthesis of Tree Biodiversity in Tropical America with Plot Inventories



Turner's Hall Woods, Barbados



SynTreeSys compiles the available plot-based knowledge of tree biodiversity across Tropical America to address fundamental ecological and biogeographical questions. Thanks to your invaluable contribution, we are conducting a novel and unparalleled compilation of vegetation inventories from multiple networks, to bring a step change to our understanding of tree biodiversity in Latin America.

The project's primary objectives are: (1) assessing patterns and drivers of tree diversity and dominance, (2) mapping hotspots of exceptional tree species turnover, and (3) evaluating the IUCN conservation status of tropical tree species in America.

Funded by the Center for the Synthesis and Analysis of Biodiversity of France (FRB-CESAB), since 2022 the project has been developed through six in-person workshops, and additional online meetings (details on the left), where participants worked together on specific workflows needed to achieve the objectives outlined above.

6th SynTreeSys workshop, December 2024

This workshop was held in Brazil at ESALQ, Escola Superior de Agricultura "Luiz de Queiroz", which is located in the Forest Ecology and Restoration Lab (LERF) at the campus of the Universidade de São Paulo in the city of Piracicaba, SP.

The discussions centred on key topics that included updates on the SynTreeSys database, emphasizing new dataset integration and strategies for enhancing community engagement through the webinars and publications. Participants reviewed and worked on the ongoing research papers.



Updated interactive plot map [here](#)

12 networks and 4 datasets
~13000 plots
>840 collaborators



Previous workshops:

Workshop 1 (May 2022): a common data structure, mandatory metadata were defined.

Workshop 2 (November 2022): definition of the SynTreeSys data sharing agreement, and discussion of hypotheses, and publication plan.

Virtual meeting (April 2023): discussion on data request and cross-network data harmonisation.

Workshop 3 (June 2023): taxonomic standardisation finalised in collaboration with the World Flora Online (WFO). Definition of structure of the scientific papers and associated data.

Virtual meeting (September 2023): future funding, and extended collaboration with researchers from Costa Rica and Mexico.

Workshop 4 (December 2023)
Hosted by Instituto Alexander von Humboldt, Colombia:
enhanced connections and communication among Latin American researchers and policymakers.

Authorship and contribution policies for SynTreeSys were discussed to ensure transparency and fairness. The workshop concluded with a forward-looking session on the future directions of SynTreeSys, focusing on identifying new opportunities for collaboration.

Database harmonisation

A new version of the database was released with massive improvement after quality check and integrating new datasets. A database template was streamlining for new and faster data gathering in the future.

SynTreeSys publication plan: analyses and manuscripts in preparation!

1. Tree diversity across major biomes in tropical America

This paper aims to describe the main features of tree diversity across biome types in tropical America (e.g., tropical rain forests, dry forests, montane forests, savannas).

Main progress has been made on mapping plots across EFG (ecosystems functional groups), calculating and reporting number of species shared and assessing species uniqueness by biome type (EFG), and finally testing neutral theory applying the "neutr" R package for species abundance distribution modelling.

2. Drivers of Alpha Diversity

The main goals of this paper are to assess whether (1) the divergent evolutionary histories and biogeographies of biomes and ecosystems influence tree species richness or whether differences in species richness among biomes and ecosystems are due simply to climate, and (2) whether divergent ecological processes across ecosystems lead to varying relationships between climate and species richness.

In this analysis, we evaluate the relationships between climate variables and species richness, taking into account potential differences between major tropical EFGs (ecosystem functional groups).

During the workshop, we clarified the causal relationships expected between climate variables and species richness to build the statistical model that evaluates how climate shapes species richness, and how this can change across EFGs.

3. Vulnerability of Tree Species and Communities to Global Change:

In this study, we are mapping the distribution of tree species across tropical America to investigate: (a) the spatial patterns of species abundance; (b) how many trees have been lost as a consequence of land use changes; (c) the climate sensitivity of tropical America tree species and (d) how future changes in climate and land use will affect species distribution and abundance.

During the workshop efforts were focused on improving the code to model species distributions and abundance, and predict abundance under current and different future climate scenarios. The group resolved crucial technical challenges, including acquiring future climate scenarios layers and managing data storage.

SynTreeSys Branch project presentations



Viviana Ceccarelli – PhD student at the University of Leeds (UK)

Title: Tree Hyperdominance: Success and vulnerability of tropical America's forest

Workshop 5 (June 2024):

Webinar for each of the three papers in progress were defined, as well as three branch projects led by students

Workshop 6

Piracicaba, December 2-6, 2024



Participants in front of LERF, ESALQ, Piracicaba, Brazil

Renato Lima
Toby Pennington
Géraldine Derroire
Claire Fortunel
Roy González
Jérôme Chave
Adriane Esquivel-Muelbert
Guilherme Gritz
Viviana Ceccarelli
Cecília Blundo
Tamara Heartsill-Scalley
Filipe França
Hans ter Steege
Oliver Phillips
Jesus Aguirre
Moabe Fernandes
Rodrigo Bergamin
Paulo Prado
Kyle Dexter
Karina Banda-R

Viviana presented part of the results of her first thesis chapter, here a brief summary of her study:

Hyperdominance is a critical concept for ecological research and conservation, serving as a practical proxy for the immense tree diversity in tropical biomes by focusing on a smaller subset of dominant species. This study explores hyperdominance patterns using a vast dataset of 3216 abundance plots, 2953 biomass plots, and 1767 productivity plots spanning ten forest and savanna biomes in Tropical and Subtropical America. Applying a spatially stratified resampling approach, the study investigates whether hyperdominance in terms of abundance, biomass, and productivity is consistent across biomes, how these patterns differ within and between biomes, and which biogeographical and environmental drivers might influence hyperdominance.

Guilherme Gritz – PhD student at the Universidade de São Paulo (Brazil)

Title: Endemism, extinction risk, and evolutionary distinctiveness of the Neotropical arborescent flora.

Guilherme presented the progress made in his first year of the PhD, here a brief summary of his project:



The rapid human impact on ecosystems has triggered a concerning rate of species extinction. Tropical America has the greatest diversity of trees on the planet and has been continuously affected by the intense conversion of natural environments into anthropized ones. Limitations imposed by the scarcity of human and financial resources impel conservationists to identify which species need the highest priority for conservation. The project will identify this region's arborescent endemic species and assess their extinction risks (today and in the future), considering their phylogenetic importance, as a way of prioritizing conservation.

To accomplish his goals, Guilherme and Renato Lima (his supervisor) have been working to improve and update the plantR package, which provides efficient tools to download, process, clean, and export plant species occurrence records from biological collections. The package also includes a set of functions for taxonomic checking, contrasting species names with different backbones such as World Flora Online or any other provided by the user. *The approach is much faster and as precise as other available tools.*

Interactions with the Host of the SynTreeSys 6th meeting

Laboratório de Ecologia e Restauração Florestal (LERF) da Escola Superior Agrícola Luiz Queiroz (ESALQ).



Renato Lima gave an introduction to the LERF's over 30 years of work and research. Gabriela Albuquerque presented her doctoral research that focused on potentializing carbon sequestration in active restoration projects.

Volunteer research student Andre Montanari presented the project of tree identification and mapping of the ESALQ Park, and doctoral student Amanda Fernandes presented on the governance aspects of the Pacto pela Restauração da Mata Atlântica.

Report of the previous SynTreeSys webinars

Each of the working groups invited the SynTreeSys community to participate in an online presentation and discussion of initial progress of the manuscripts.

The webinars were presented in Spanish, the text of the slides in English, questions were received in Portuguese, Spanish, French and English.

1. Synthesis of Tree Diversity (11/07/2024): 93 participants

2. Vulnerability of Tree Species and Communities to Global Change. (04/09/2024): 78 participants

3: Drivers of Alpha Diversity (24/09/2024): 75 participants

THANKS FOR JOINING US!
The Sysntreesys group wishes all a great festive season and a happy 2025!

OBRIGADO!

GRACIAS!

Lecture Seminar Series (LERF palestras)

SynTreeSys group organized an event to interact with the local scientific community. The event called: '*Understanding Tropical Forests*' featured a series of 20-30 minute lectures by experts of the SynTreeSys group, which shared discoveries, recent research, and knowledge about forests, savannas, and other biomes of Tropical America.

The event took place from November 28 to December 6 2024 at ESALQ/USP, in Piracicaba, but it was also streamed online. Around 114 professors, researchers, undergraduate and graduate students joined in person and another 193 people joined the online transmission of the 6 lectures. The event was very successful and fulfilled the role of disseminating new research and the project with Brazilian actors and also with all the SynTreeSys community.

6 palestras

- 28/11** **FUNCTIONAL COMPOSITION OF THE AMAZONIAN TREE FLORA AND FORESTS**
Hans ter Steege - Holanda
- 29/11** **O STATUS DE CONSERVAÇÃO DA FLORA ARBÓREA DA MATA ATLÂNTICA**
Renato Lima - Brasil
- 03/12** **TROPICAL FOREST RIPARIAN ZONES IN AREAS WITH DIFFERENT PAST LAND USE**
Tamara Heartsill Scalley - Puerto Rico
- 04/12** **TROPICAL PLANT DIVERSITY, BIOGEOGRAPHY AND CONSERVATION: A MULTI-BIOME APPROACH**
Toby Pennington - Reino Unido
- 05/12** **ABIOTIC AND BIOTIC DRIVERS OF TREE ASSEMBLY AND DYNAMICS**
Claire Fortunel - França
- 06/12** **COMMONNESS AND RARITY IN TROPICAL TREES**
Jerome Chave - França