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Thirty-two years of inventory data (1986–2018) from the GUYADIV forest plot network in French Guiana, covering 100 ha and 90,000 trees

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Abstract

Key message The GUYADIV dataset compiles inventory data from over 100 hectares of lowland tropical forest plots across French Guiana, encompassing 90,000 trees from 1,393 species. It provides a solid foundation for investigating patterns of diversity and function in tropical tree communities at multiple spatial scales. It is available at https://doi.org/10.23708/RLYCVQ; and the associated metadata at https://metadata-afs.nancy.inra.fr/geonetwork/srv/fre/catalog.search#/metadata/da2fb3a7-8669-499d-b8c1-258da68b8f85

Keywords French Guiana, Amazonian forests, Tropical rainforests, Forest inventory, Tree species diversity, Dbh

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1 Background

The Amazon rainforest is the largest and most tree species-rich tropical forest on Earth, harbouring an estimated 16,000 tree species (ter Steege et al. 2013; 2020). This exceptional diversity supports key ecosystem services and contributes to the resilience of Amazonian forests to climate change (Steur et al. 2022). Yet, much of this biodiversity remains poorly documented (Feeley 2015) because of the vast extent of the region and the limited accessibility of remote areas.

Here, we present GUYADIV, a network of forest plots in French Guiana established in 1986 to document tree diversity in *terra firme* forests. By tree, we mean self-supporting, ligneous perennial plants with dbh above a predefined threshold, including palms (see Sect. 2.5). The network comprises 242 plots totalling over 100 ha and 90,000 trees, 98% identified to species level, with inventories conducted between 1986 and 2018. Whilst making GUYADIV dataset openly accessible, this paper reviews its main scientific applications and explores its potential for reuse, particularly to optimise future inventories in French Guiana.

2 Methods

2.1 Study area and forest characteristics

GUYADIV forms a network of forest inventory plots covering over 100 hectares across French Guiana, spanning a broad elevational range (from 30 to 800 m a.s.l., although most plots are located below 400 m) and much of the north–south climatic gradient, with annual rainfall ranging from approximately 2,000 mm to almost 4,000 mm across the plots (Fig. 1).

The network was established to study tree communities in French Guiana, with a particular focus on species co-occurrence at different spatial scales, primarily in *terra firme* forests. Accordingly, most plots are located in old-growth *terra firme* forests that have experienced little or no recent disturbance. A few plots are located in disturbed forests, either following recent logging (Molino and Sabatier 2001) or reflecting ancient pre-Columbian occupation (e.g., Odonne et al. 2019). Other plots include small patches of swamp forest (e.g., Sabatier et al. 1997). Several exhaustive inventory plots specifically target monodominant *Spirotropis* (Fabaceae) forests (Fonty et al. 2011).

Some GUYADIV plots are located within long-term research stations, including the older, now less active

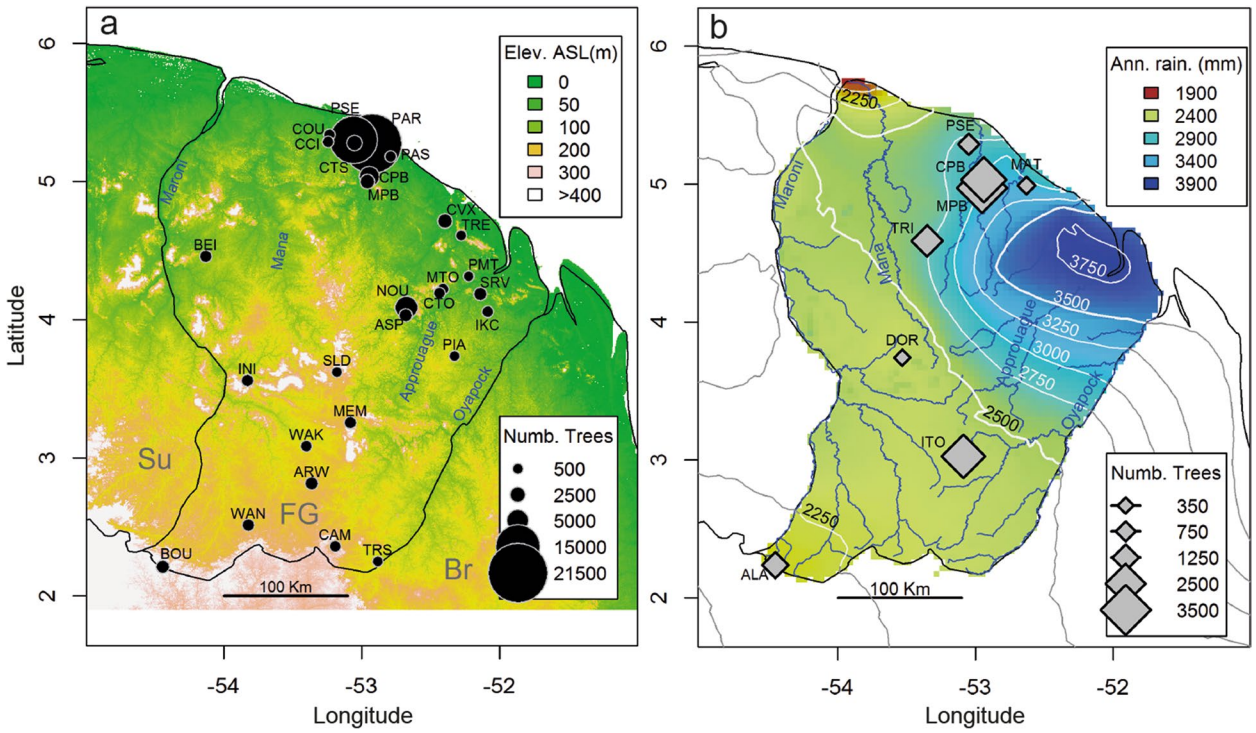


Fig. 1 Location in French Guiana of (a) exhaustive and (b) non-exhaustive GUYADIV plots (the latter following the Point-Centered Quarter method; see Sect. 2.3.2). Site labels according to the 'plots' table of the dataset. Topography from SRTM (Farr et al. 2007); isohyets from WordlClim 2 (Fick and Hijmans 2017)

Piste de Saint-Élie station, and the still-active Nouragues and Paracou stations.

The geographical coordinates of the centre of each plot are provided in the 'plots' table in the dataset. The shape and location of the plots are shown in the GUYADIV plots shapefiles (EPSG 4326, WGS 84). The positional uncertainties associated with the geographical coordinates provided in the shapefiles' attribute tables were estimated based on the geolocation methods used. These uncertainties range from 1 to 100 m: 1 m for plots surveyed by a surveyor, 10 m for those georeferenced using GPS, and up to 100 m for those located using maps.

In the GUYADIV plots shapefiles, each plot is represented by its actual shape and size at ground level (i.e., without slope correction). For most plots, the geographical location of the starting point of PCQ plots, or of the origin point (x0, y0) of exhaustive plots (see Sect. 2.3 for details on the inventory designs), is also provided in a dedicated shapefile.

2.2 Genesis of the GUYADIV network: founders and key contributors

The GUYADIV dataset was initiated in 1986 by a core team of botanists specialising in tree identification and ecology, DS and MFP, joined by JFM in 1993. Data collected before 1993 were computerised in a database management system developed by DS in 1986. From 1994 onwards, GUYADIV data have been managed in a relational system designed and continuously refined by JFM, while DS maintained a complementary GIS database.

Over the years, the GUYADIV network has further expanded (Fig. 2) through contributions from researchers affiliated with various national and international institutions. The full list of contributors is provided in the 'contributors' table of the dataset. Among the main contributors, DS initiated most of the plots, contributing to 95% of them and to 65% of tree identifications. JFM contributed to 48% of the plots, including all plots censused twice, and to 48% of tree identifications. MFP contributed to 27% of the plots and 25% of tree identifications and played a pivotal role in maintaining taxonomic updates until 2013.

2.3 Inventory design

The GUYADIV dataset comprises data collected from inventory plots of the GUYADIV network. These plots fall into two categories: exhaustive plots, which cover the entire community of trees within a delimited area, and non-exhaustive plots, which sample a subset of trees around regularly spaced sampling points using the

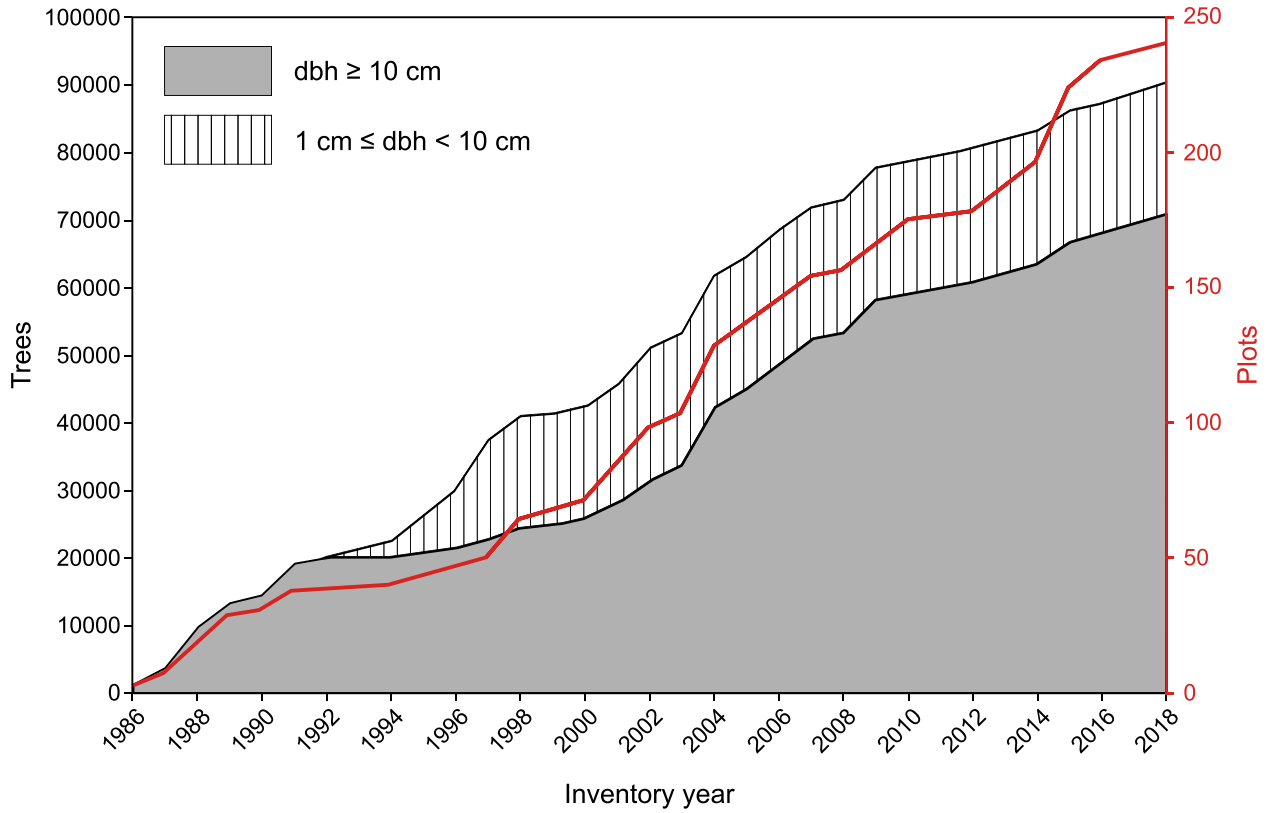


Fig. 2 Number of plots (red line) and trees inventoried (grey area: dbh ≥ 10 cm; hatched area: 1 ≤ dbh < 10 cm) in the GUYADIV network over time

Point-Centered Quarter (PCQ) method (Cottam and Curtis 1956) and its variants. In all cases, the sample tree community is defined by a minimum threshold for diameter at breast height (dbh), which may vary depending on the research objectives.

2.3.1 Exhaustive inventory plots

A total of 157 exhaustive inventory plots are represented in the dataset, covering a total area of 98 ha and comprising 76,416 trees. Plot size ranges from 0.04 to 1.4 ha, and plot shapes are either square or rectangular, with some being irregular to accommodate local topographical or environmental constraints (e.g., TRE1 plot at Réserve Trésor site (TRE) – see the 'plots' table of the dataset for the complete list of plots and acronyms).

The three plots at the Crique Passoura (PAS) site (PAS1, PAS2 and PAS3; 0.7 ha, 0.46 ha and 0.24 ha, respectively) constitute a special case, which can be described as 'exhaustive-disjoint'. Each plot consists of a linear series of paired 10 m × 10 m subplots, each exhaustively surveyed and spaced 100 m apart. Some plots are nested within larger blocks (e.g., plots within the 'Biodiversity Block' at Piste de Saint-Élie, PSE site, Fig. 3).

In each plot, trees were identified as precisely as possible, individually tagged, their dbh was measured, and their positions were recorded using a plot-specific local coordinate system, with the origin located at a plot or block corner.

In most cases, the relative positions of trees within the exhaustive inventory plots were recorded in the field with an accuracy of 0.1–0.5 m, using a 10 × 10 m square grid delimiting the subplots defined in the 'trees' and 'plots' tables. However, for around 17,000 trees, the x and/or y coordinates were either not recorded in the field during the corresponding surveys or were not entered into the database.

2.3.2 Non-exhaustive inventory plots

A total of 85 non-exhaustive inventories are represented in the dataset. These inventories follow the Point-Centered Quarter (PCQ) method or modified versions thereof, and include a total of 13,993 trees.

The standard PCQ method consists of surveying trees around inventory points spaced at regular intervals (20 m apart in all GUYADIV inventories) along a more or less straight baseline, generally oriented towards a predefined azimuth and of variable length. The space around each point is virtually divided into four quadrants, and the tree closest to the point in each quadrant is censused. This sampling design therefore covers only a fraction of the stems within a given area. Unlike exhaustive inventories,

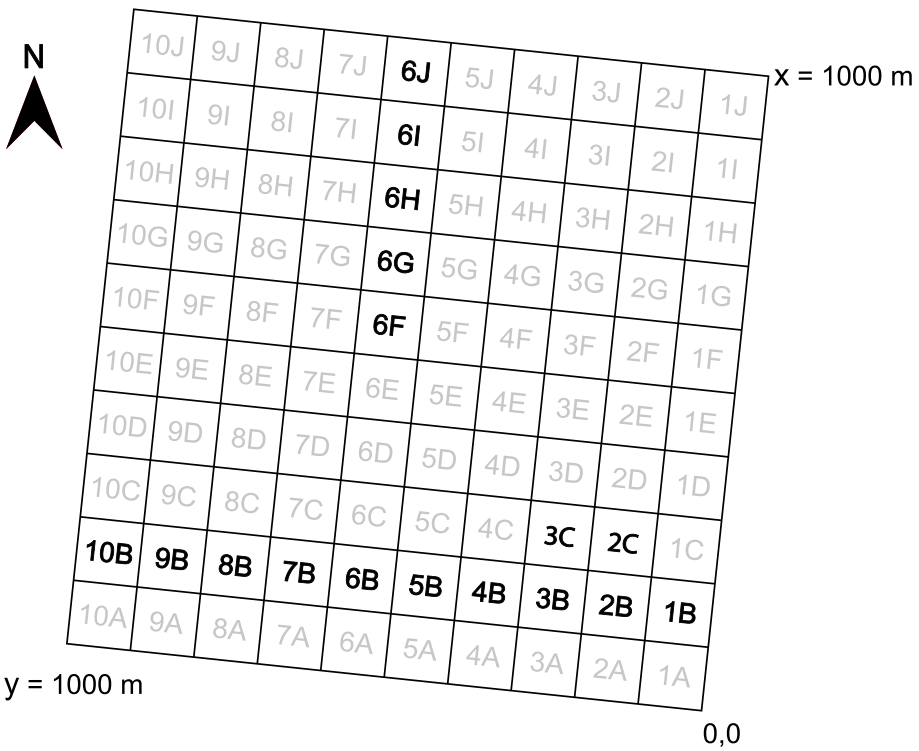


Fig. 3 The 'Biodiversity Block' at Piste de Saint-Élie, composed of 100 1-ha plots. In bold, the 17 Piste de Saint-Élie (PSE) plots included in GUYADIV. Other plots have not yet been censused

PCQ inventories do not record the x and y coordinates of individual trees.

To meet the requirements and objectives of various research projects, five variants of the PCQ method were used. These variants differ in the number of baselines making up the inventory, the deviation of the baseline geometry from the above-mentioned standard, or the number of trees surveyed around each point. Each variant is identified by a code referring to its distinctive features:

•PCQ:1S:4 (Fig. 4a,d): 1 standard baseline; 4 trees per point. This is the standard PCQ method.

•PCQ:1S:4–8 (Fig. 4a,e): 1 standard baseline; 4 to 8 trees per point. In each quarter, the top-canopy tree is included, provided that it has not already been censused.

•PCQ:1S:8–9 (Fig. 4a): 1 standard baseline; 8 or 9 trees per point. The top-canopy tree above the point is added if it is distinct from the eight trees already censused.

•PCQ:3S:4 (Fig. 4b,d): 3 standard parallel baselines spaced 20 m apart along a toposequence; 4 trees per point.

• PCQ:1C:8 (Fig. 4c,f): 1 baseline comprising 14 points, with its geometry constrained to fit within a 2-ha area (200 × 100 m); 8 trees per point.

2.4 Botanical identification

In the GUYADIV dataset, 98% of the trees were identified to species level following the APG IV classification (The Angiosperm Phylogeny Group 2016). This work was supported by French Guiana herbarium (*Herbier IRD de Guyane*, CAY, Gonzalez et al. 2021), which houses nearly

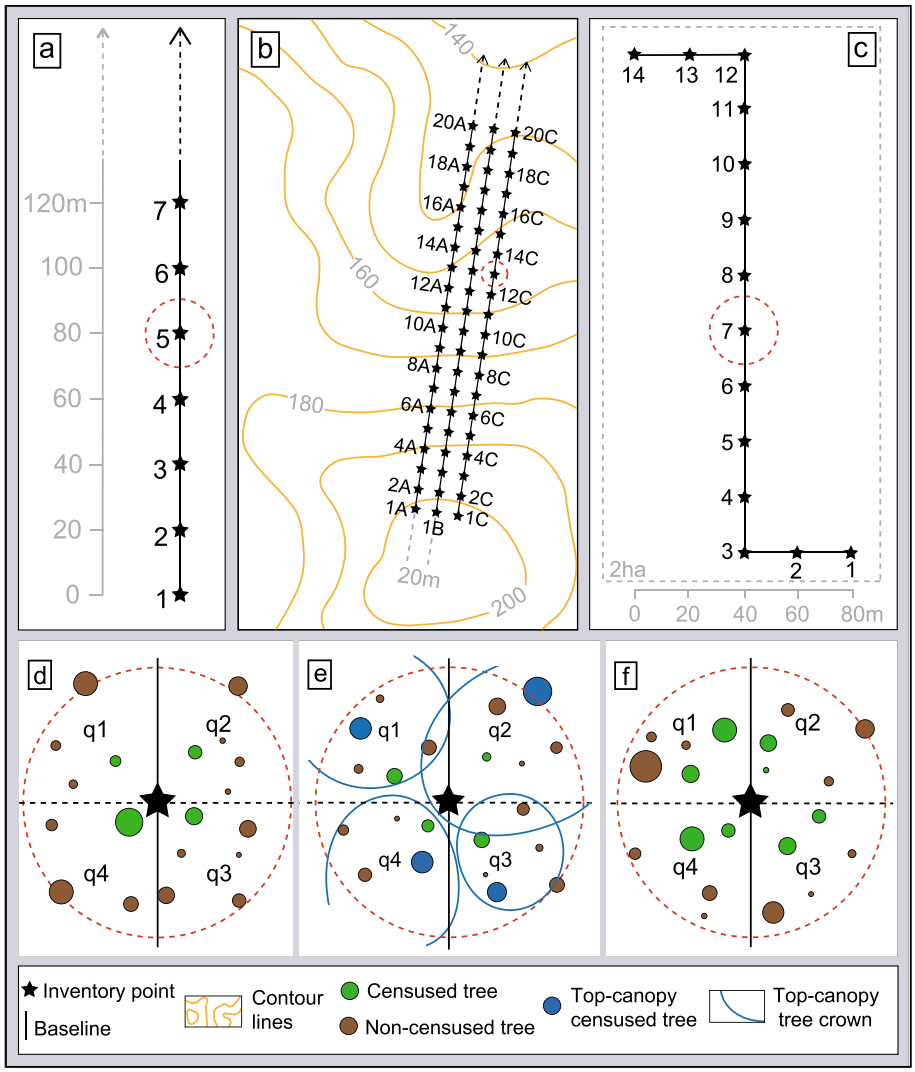


Fig. 4 Graphical representation of the PCQ methods used in GUYADIV (see text for details). **Top**, general layout of the baseline(s) and inventory points. a: PCQ:1S:4 (standard method); b: PCQ:3S:4 variant; c: PCQ:1C:8 variant. **Bottom**, census protocol at each inventory point. d: 4 trees per point, PCQ:1S:4 (standard method) and PCQ:3S:4 variant; e: 4 to 8 trees per point, PCQ:1S:4–8 variant; f: 8 trees per point, PCQ:1C:8 variant; the PCQ:1S:8–9 variant (not shown) differs from the panel f only by the addition of a top-canopy tree, if distinct from the eight trees already censused

40,000 specimens collected from trees in French Guiana and benefits from careful curation and collaboration with international specialists.

Common and well-recognised species, representing 50–80% of the trees depending on the plot, were identified in the field using 10×40 binoculars, usually by two botanists working together (most often DS and MFP, DS and JFM, DS or JFM and JE). Samples were taken from the remaining 20–50% of trees for further identification. These samples were collected either by climbing trees with a climbing rope, using a pole pruner, or shooting branches from the ground with an elongated single-barrel shotgun. Fertile specimens of uncommon or unknown species were systematically sought, either near the inventoried plots or by revisiting plots whenever possible, even several years after the initial census.

Representative specimens were deposited as herbarium vouchers at CAY (see the 'trees' table in the GUYADIV dataset and Molino et al. 2022 for a complete list of representative herbarium specimens). Other botanical samples, mostly sterile and sometimes collected from trees at an early developmental stage, were kept at the AMAP laboratories in Cayenne and Montpellier and used for subsequent identification, alongside the CAY collections. The botanists responsible for identification (DS, MFP and JFM, joined by JE in 2015) developed a common identification approach based primarily on vegetative characters. For most species, careful comparative examination of sterile material alone allows for reliable identification (Gentry 1993; Keller 2004; Engel et al. 2016). Herbarium vouchers deposited at CAY, together with duplicates sent to various international herbaria, further supported species identification by specialists across numerous plant families.

A total of 1,393 species are recorded in the GUYADIV dataset, belonging to 370 genera and 84 families. Among these, 1168 are formally published species, while 225 have provisional names. Taxonomic or nomenclatural updates were incorporated during 2025 based on the checklist of tree species of French Guiana (Molino et al. 2022), relevant recent literature (Biral 2019; Kochanovski 2019; Gardner et al. 2021; Soares et al. 2021, 2022; Borges et al. 2022; de Lima et al. 2022; de Mestier et al. 2022; Peraza et al. 2022; Souza et al. 2022; Maas et al. 2023; Swenson et al. 2023; Vargas et al. 2024), and the French national taxonomic reference system TAXREF v18.0 (TAXREF 2025). Uncertainties regarding botanical identification have been recorded in a specific column of the 'trees' table.

Overall, 1,589 trees (1.8%) remained unidentified at the species level, while 4,374 trees (4.8%) were identified by the 225 provisional names, e.g. 'Pouteria sp. B', 'Eugenia FG-9' or 'Lauraceae sp. 11' (Molino et al. 2022). These species – often inaccurately referred to as 'morphospecies' – are either (i) species that could not be accurately identified without fertile material, (ii) cryptic species within species complexes (Bacon et al. 2022), or (iii) in many cases, new species that have never been formally described. These provisionally named species were standardised by comparing collected herbarium vouchers across plots as described above.

2.5 Tree diameter measurement and phenology

In GUYADIV, 'tree' refers to a self-supporting, ligneous perennial plant with one or more main stems (trunks) having a dbh equal to or above a predefined threshold. This threshold was 10 cm for 78% of the trees censused, but was 1 cm in the SPA to SPD plots in the *Spirotropis* area of Piste de Saint-Élie – Crique Toussaint site (CTS). A threshold of 2 cm was used in the PSE5B-10B and PSES plots at Piste de Saint-Élie (PSE), and in the PAR1 to PAR16 plots at Paracou (PAR). Palm trees are included because their stipe is ligneous and because they occupy the same position in the forest structure as woody trees.

GUYADIV was primarily designed to characterise tree communities, i.e. the co-occurrence of species at different spatial scales, rather than to monitor tree growth dynamics or changes in biomass through repeated measurements. The diameter measurement protocol is broadly similar to those used in other forest plot networks, such as RAINFOR (Malhi et al. 2002), but the point of measurement was not permanently marked, and measurements were taken at approximately 1.3 m above the ground. For large buttressed trees, the diameter was estimated from the ground, without using a ladder to reach the point of measurement above the buttresses. In plots PSE5B-10B and PAR1 to PAR11, trees with a dbh in the range [2–10[cm were measured at the initial census using fixed-size gauges with 0.5-cm-wide classes.

Most plots were inventoried only once. However, some plots were re-inventoried once, several years after the initial census. In total, 20,652 trees from Piste de Saint-Élie (PSE) and Paracou (PAR) sites were re-inventoried. At Piste de Saint-Élie, ten plots in the 'Biodiversity Block' (i.e. the 'B' strip on Fig. 3, including trees with a dbh of 2–10 cm), as well as the PSEP and PSER plots, were re-inventoried in 2002–early 2003. At Paracou, trees with a dbh of 2–10 cm were re-inventoried in 2002 in ten plots (PAR1 to PAR11). These repeated measurements should therefore be interpreted with caution, as the point of measurement was not permanently marked and other sources of measurement uncertainty may affect comparisons between censuses (see Sect. 4, Technical validation).

During the initial censuses, the phenological stage of the trees was recorded, distinguishing between sterile stage (defoliated or not), flowering stage (with buds or open flowers), and fruiting stage (with immature or

mature fruits). Overall, 96.5% of trees with a dbh ≥ 10 cm, and nearly all trees with a dbh < 10 cm, were recorded at the sterile stage.

For the 23,681 trees that were re-inventoried, the dataset identifies newly recruited individuals that reached the dbh threshold and records dead trees, with information on the type of death (e.g., broken, fallen) when available.

3 Access to data and metadata description

The GUYADIV dataset (Sabatier et al. 2024) is available in the IRD DataSuds repository: https://doi.org/10.23708/RLYCVQ. The associated metadata are available at https://metadata-afs.nancy.inra.fr/geonetwork/srv/fre/catalog.search#/metadata/da2fb3a7-8669-499d-b8c1-258da68b8f85

Georeferenced shapefiles of the plots (Sabatier 2026) are available in the IRD DataSuds repository: https://doi.org/10.23708/T2UC4M

The GUYADIV dataset consists of four tables, provided either separately in *.csv* format or combined into a single Excel file with four sheets, one for each table (Table 1). The 'trees' data table is composed of 90,409 lines corresponding to the number of trees and 33 columns (tree descriptors), while the 'plots' data table is composed of 242 lines (corresponding to the number of plots) and 21 columns (plot descriptors).

4 Technical validation

Because GUYADIV was primarily designed to characterise tree communities rather than to monitor tree growth dynamics, uncertainty in dbh measurements was considered a key issue during data curation. Potentially problematic dbh values were identified from field notes, and the main sources of measurement uncertainty were documented in the 'dbh_pbl' column of the 'trees' table. These uncertainties primarily concern irregular trunk shapes (e.g., fluted, buttressed or fenestrated trunks) and palms with the foliar base still present. The 'dbh_pbl' column therefore provides an explicit indication of measurements that should be treated with caution in analyses involving tree diameter.

Although most plots were inventoried only once, repeated measurements are available for 20,652 trees from Piste de Saint-Élie (PSE) and Paracou (PAR) sites. We used these data as an additional consistency check, excluding measurements flagged in 'dbh_pbl' and aberrant negative annual increments of less than −0.2 cm year^{-1} (Gourlet-Fleury et al. 2004). The resulting mean annual dbh increment for non-palm trees was 0.12 cm year^{-1} (n = 5,860), within the range (0.09—0.17 cm year-1) reported for a nearby undisturbed plot at the Paracou (PAR) site dedicated to forest dynamics studies (Demenois et al. 2003).

5 Previous uses and scientific impact

GUYADIV has already had a strong scientific impact, contributing to numerous studies addressing a wide range of research questions at local, regional, continental and global scales (Table 2). At larger spatial scales, the integration of GUYADIV 1-ha plots into major international networks, notably the Amazonian Tree Diversity Network (ATDN) (n.d.) and Forestplots.net (Lopez-Gonzalez et al. 2011), has enabled their inclusion in studies spanning the Amazon Basin and beyond.

GUYADIV has also contributed to documenting the tree flora of French Guiana through the numerous botanical vouchers collected during inventories. These collections have contributed to the discovery and confirmation of several hundred tree species in the region and to the establishment of comprehensive checklists of the French Guianan tree flora (Molino et al. 2009; 2022).

6 Reuse potential and limits

As illustrated in the previous section, the GUYADIV dataset has strong potential for reuse in addressing a wide range of research questions related to tree community assembly and functioning. Beyond species abundances, the dataset also provides information on tree size through dbh measurements and can be combined with functional and life-history traits from existing databases. However, some limitations should be considered when assessing its reuse potential. Most notably, the plots provide snapshots of forest diversity at the time of each inventory and are not maintained as permanent research plots. The inventories are asynchronous and do not form continuous time series, limiting the ability of the dataset to capture short-term temporal changes in species

Table 1 Description of the different tables of the GUYADIV dataset

Table name	Main information provided
plots	Information for each plot: acronym, site name, altitude, geographic coordinates, plot type, dimensions, inventory date(s), minimum dbh threshold
trees	List of censused trees, including tree labels, relative coordinates within the plots, botanical identifications, vouchers, dbh, phenological stages
contributors	People involved in the inventories, with a description of the nature and importance of their contributions
description_of_variables	Definitions and explanations of the variables (columns) included in each table

Table 2 Scientific publications using data from GUYADIV, indicating the geographic scale, general research theme, and GUYADIV plots included in each study

Reference	Geographic scale	Theme	GUYADIV plots
Sabatier et al. (1997)	Local (< 100 ha)	Influence of soil cover patterns on tree community structure and composition	19 1-ha plots (PSE)
Molino (1999)	Local (< 100 ha)	Relationships between disturbance and species diversity	10 0.5-ha plots (PAR); one 1-ha plot (PSE)
Roggy and Prévost (1999)	Local (< 100 ha)	Nitrogen-fixing legumes and silvigenesis	10 1-ha plots (PSE)
Roggy et al. (1999)	Local (< 100 ha)	Nitrogen-fixing legumes and silvigenesis	10 1-ha plots (PSE)
Birnbaum (2001)	Local (< 100 ha)	Topographic surface of the tree canopy	10 1-ha plots (PSE)
Molino and Sabatier (2001)	Local (< 100 ha)	Relationships between disturbance and species diversity	10 0.5-ha plots (PAR); one 1-ha plot (PSE)
Pélissier et al. (2002)	Local (< 100 ha)	Relationships between tree species diversity and hydrological soil constraints	10 1-ha plots (PSE)
Domenach et al. (2004)	Local (< 100 ha)	Diversity of the leguminous tree—*Rhizobium* nitrogen-fixing associations	10 1-ha plots (PSE)
Madelaine et al. (2007)	Local (< 100 ha)	Habitat preference, species guild, mortality and recruitment	12 1-ha plots (PSE)
Vincent et al. (2011)	Local (< 100 ha)	Dispersal limitation, habitat preference, and distribution of tree saplings	10 0.5-ha plots (PAR)
Baraloto et al. (2012)	Local (< 100 ha)	Relationships between disturbance and functional diversity	10 0.5-ha plots (PAR)
Vincent et al. (2012a)	Local (< 100 ha)	Relationships between canopy surface and forest architecture	10 0.5-ha plots (PAR)
Roggy et al. (2014)	Local (< 100 ha)	Different strategies of Nitrogen uptake among tree species	3 1-ha plots (CPB); 3 1-ha plots (MPB)
Caron et al. (2019)	Local (< 100 ha)	Chloroplast DNA polymorphism and local introgression	19 1-ha plots (PSE)
Bodin et al. (2020)	Local (< 100 ha)	Anthracological study reveals pre-Columbian occupation patterns	3 1-ha plots (NOU); 3 1-ha plots (ASP)
Couteron et al. (2003)	Landscape (< 200 km^2)	Relationships between tree species and environment	10 0.5-ha plots (PAR); 11 0.12-ha plots (COU); 8 0.12-ha plots (CCI)
Fonty et al. (2011)	Regional (Northern French Guiana)	Monodominance of *Spirotropis longifolia*	6 1-ha plots (PSE); 6 1-ha plots (CVX)
Vincent et al. (2012b)	Regional (Northern French Guiana)	Detection of forest structure through remote sensing	4 1-ha plots (CPB); 4 1-ha plots (MPB); 13 1-ha plots (PSE)
Le Roux et al. (2024)	Regional (Northern French Guiana)	*Spirotropis longifolia* and *Bradyrhizobium* Nitrogen-fixing associations	2 1-ha plots (CVX); 2 1-ha plots (PSE)
Paget (1999)	Regional (French Guiana)	Patterns of tree species diversity	12 0.12-ha plots (CPB); one 0.12-ha plot (PSE)
Sabatier et al. (2006)	Regional (French Guiana)	Multi-scale evaluation of tree species diversity	All CPB, MPB, COU and PSE plots
Molino et al. (2009)	Regional (French Guiana)	Checklist of tree species with demographic data	Whole 2009 GUYADIV dataset
Guitet et al. (2014)	Regional (French Guiana)	Tree species diversity indices derived from forestry survey	Whole 2013 GUYADIV dataset
Sabatier et al. (2018)	Regional (French Guiana)	Environmental and anthropogenic drivers of forest turnover	Whole 2017 GUYADIV dataset
Odonne et al. (2019)	Regional (French Guiana)	Influence of pre-Columbian occupations on present-day tree community	One 1-ha plot (CTO); one 1-ha plot (MTO)
Heuertz (2020)	Regional (French Guiana)	Genetic heterogeneity of *Eschweilera* spp.	Whole 2020 GUYADIV dataset
Molino et al. (2020)	Regional (French Guiana)	Influence of pre-Columbian occupations on present-day tree community	62 1-ha plots (24 sites)
Molino et al. (2022)	Regional (French Guiana)	Checklist of tree species with demographic data	Whole 2021 GUYADIV dataset
Marcon et al. (2024)	Regional (French Guiana)	Estimation of the number of tree species in French Guiana	68 1-ha plots (21 sites)

Table 2 (continued)

Reference	Geographic scale	Theme	GUYADIV plots
Sabatier (1987)	Continental (Guiana Shield)	Description of new species	Whole 1986 dataset
Gond et al. (2011)	Regional (Guiana Shield)	Broad-scale spatial pattern of forest landscape through remote sensing	53 1-ha plots and 5 0.5-ha plots (14 sites)
Engel and Sabatier (2020)	Continental (Guiana Shield)	Description of new species	Whole 2018 dataset
Engel et al. (2022)	Continental (Guiana Shield)	Description of new species	Whole 2018 dataset
Pos et al. (2014)	Continental (Guiana Shield and Ecuador)	Are all species necessary to reveal ecological patterns?	63 1-ha plots (20 sites) in ATDN
Pos et al. (2017)	Continental (Guiana Shield and Ecuador)	Modelling tree species migration in forests	63 1-ha plots (20 sites) in ATDN
ter Steege et al. (2000)	Continental (Amazonia)	Floristics and diversity	28 1-ha plots (4 sites) in ATDN
ter Steege et al. (2003)	Continental (Amazonia)	Modeling tree α-diversity	30 1-ha plots (6 sites) in ATDN
ter Steege et al. (2006)	Continental (Amazonia)	Patterns of canopy tree composition	Large trees from 22 plots (PSE) in ATDN
Stropp et al. (2009)	Continental (Amazonia)	Regional *vs* local tree species diversity	64 1-ha plots (20 sites) in ATDN
ter Steege et al. (2015)	Continental (Amazonia)	Conservation status of 15,000 tree species	63 1-ha plots (20 sites) in ATDN
ter Steege et al. (2016)	Continental (Amazonia)	Checklist of tree species	63 1-ha plots (20 sites) in ATDN
Levis et al. (2017)	Continental (Amazonia)	Pre-Columbian tree domestication	68 1-ha plots (21 sites) in ATDN
Gomes et al. (2018)	Continental (Amazonia)	Tree species distribution modelling	68 1-ha plots (21 sites) in ATDN
Pos et al. (2019)	Continental (Amazonia)	Scaling issues of neutral theory for dominant tree species	63 1-ha plots (20 sites) in ATDN
ter Steege et al. (2019b)	Continental (Amazonia)	Dynamic checklist of tree species	68 1-ha plots (21 sites) in ATDN
ter Steege et al. (2019a)	Continental (Amazonia)	Rarity of monodominance in tree communities	68 1-ha plots (21 sites) in ATDN
ter Steege et al. (2020)	Continental (Amazonia)	Estimates of tree species richness	68 1-ha plots (21 sites) in ATDN
Draper et al. (2021)	Continental (Amazonia)	Tree dominance across forest strata	68 1-ha plots (21 sites) in ATDN
Steur et al. (2022)	Continental (Amazonia)	Relationships between tree species richness and ecosystem services	68 1-ha plots (21 sites) in ATDN
Correa et al. (2023)	Continental (Amazonia)	Geographic patterns of tree dispersal modes	68 1-ha plots (21 sites) in ATDN
Peripato et al. (2023)	Continental (Amazonia)	Pre-Columbian earthworks and tree domestication	68 1-ha plots (21 sites) in ATDN
Pos et al. (2023)	Continental (Amazonia)	Unraveling tree community assembly using Maximum Information Entropy	68 1-ha plots (21 sites) in ATDN
ter Steege et al. (2023)	Continental (Amazonia)	Maps of tree density and tree species diversity	68 1-ha plots (21 sites) in ATDN
Householder et al. (2024)	Continental (Amazonia)	Tree species diversity in river floodplains forests	68 1-ha plots (21 sites) in ATDN
Luize et al. (2024a)	Continental (Amazonia)	Phylogenetic composition of tree communities	68 1-ha plots (21 sites) in ATDN
Luize et al. (2024b)	Continental (Amazonia)	Biogeography of tree flora	68 1-ha plots (21 sites) in ATDN
Sanchez-Martinez et al. (2025)	Continental (Amazonia)	Phylogenetic conservatism in the relationship between tree functions and demography	68 1-ha plots (21 sites) in ATDN
ter Steege et al. (2025)	Continental (Amazonia)	Functional composition of the Amazonian tree flora and forests	68 1-ha plots (21 sites) in ATDN
ter Steege et al. (2017)	Continental (French Guiana, Brazil and Panama)	Estimating species richness in tree communities	20 1-ha plots (PSE) in ATDN
Parmentier et al. (2007)	Global (Amazonia and Tropical Africa)	Comparison of tree species diversity between Africa and Amazonia	55 1-ha plots (14 sites)
Cooper et al. (2024)	Global (Tropics)	Geographic patterns of common tree species	68 1-ha plots (21 sites) in ATDN

composition. Consequently, GUYADIV is not well suited to studying forest dynamics, monitoring biomass, or analysing ecological processes over short time periods. Nevertheless, it provides a valuable baseline for future long-term studies of forest communities.

At the same time, this limitation defines an important aspect of the dataset's reuse potential. Although GUYADIV was not designed to monitor temporal changes in forest communities, its broad spatial coverage and heterogeneous sampling effort provide a valuable basis for informing the design of future inventories. In particular, the dataset can help identify priority areas for new inventories, assess the sampling effort required to characterise tree communities, and inform the timing of future inventories in relation to phenology.

6.1 Spatial coverage and priorities for future inventories

Terra firme forests are far from homogeneous across French Guiana (Guitet et al. 2015). The GUYADIV dataset captures substantial variation in both forest structure and tree community composition across the sampled territory. Among non-monodominant exhaustive plots of approximately 1 ha (0.8–1.2 ha), with trees ≥ 10 cm dbh, tree density ranges from 382 to 1,055 stems ha^{-1} (mean = 571, SD = 112, n = 73), while species richness ranges from 92 to 211 species ha^{-1} (mean = 160, SD = 30, n = 65). These variations highlight the importance of considering the spatial coverage of existing inventories when using the GUYADIV dataset to guide the establishment of new plots or ecological studies.

The spatial distribution of existing inventory plots already reveals substantial gaps in sampling coverage. Because remote forests are difficult to access, sampling is concentrated in northern French Guiana, leaving large and relatively inaccessible areas poorly documented. These include, in particular, the lower Maroni and Mana basins in the north-west, as well as the middle Oyapock and southern Approuague basins in the east (Fig. 1).

Spatial patterns of tree diversity observed across the GUYADIV network provide complementary information for identifying areas that could be prioritised for future inventories. To characterise local species richness while accounting for differences in sampling effort, we used Fisher's alpha (Fisher et al. 1943), a descriptor of local diversity that combines species richness and abundance distribution (ter Steege et al. 2023). Fisher's alpha assumes a log-series distribution of abundances, including for relatively small samples. We therefore assessed the reliability of the corresponding standardised richness measure, $S_{500\text{-}F} = \alpha \times \ln(1 + 500/\alpha)$ (ter Steege et al. 2023), by comparing it with rarefied richness at 500 trees ($S_{500\text{-}R}$), which makes no assumption about the underlying abundance distribution. The two measures were strongly correlated ($R^2 = 0.99$, $P < 0.001$, n = 40 one-ha exhaustive plots with more than 540 trees), supporting the use of $S_{500\text{-}F}$ as a standardised measure of local richness in GUYADIV.

Fisher's alpha ranges from 33.7 to 127 (mean = 76.6, SD = 22.6, n = 65), placing GUYADIV plots in the upper half of the range reported for Amazonian forests (ter Steege et al. 2023). Local richness also shows a marked spatial structure across French Guiana (Fig. 5a). The LOESS-based geographical expectation (Cleveland et al. 1992) highlights relatively low $S_{500\text{-}F}$ values in the centre and south of French Guiana, roughly delimited by the Dorlin (DOR), Trois Sauts (TRS) and Wanapi (WAN) sites, whereas higher values are concentrated in the north-east (latitude > 3.7° N and longitude > −53°). This pattern is consistent with north-eastern French Guiana and neighbouring Amapá being among the areas of highest alpha diversity in Amazonia, while also receiving among the highest levels of annual rainfall (ter Steege et al. 2023).

Local contribution to beta diversity (LCBD) provides a complementary perspective on where additional inventories could be particularly informative (Fig. 5b). LCBD measures the uniqueness of individual sampling units in terms of community composition (Legendre and De Cáceres 2013). Most southern sites, as well as some northern sites, combine low alpha diversity ($S_{500\text{-}F}$) with high LCBD values, indicating relatively species-poor but compositionally distinctive communities. Conversely, northern sites characterised by high alpha diversity tend to have lower LCBD values, suggesting that their communities share more of the floristic components represented across French Guiana.

Taken together, these results suggest that priorities for future tree community inventories should not be based solely on geographical gaps in existing sampling. In addition to unsampled areas, priority could be given to regions likely to harbour high alpha diversity, particularly west of the upper Oyapock River, and to poorly documented areas of southern French Guiana where compositionally distinctive communities may occur. These data could also guide the selection of permanent sites intended to represent particular regions or forest types. For example, the low LCBD values at the neighbouring Rivière Arataye—Saut Pararé (ASP) and station de recherche des Nouragues (NOU) sites suggest that this extensively documented area provides a representative tree community for French Guiana, consistent with its selection as a representative site by the Muséum National d'Histoires Naturelles in 1976.

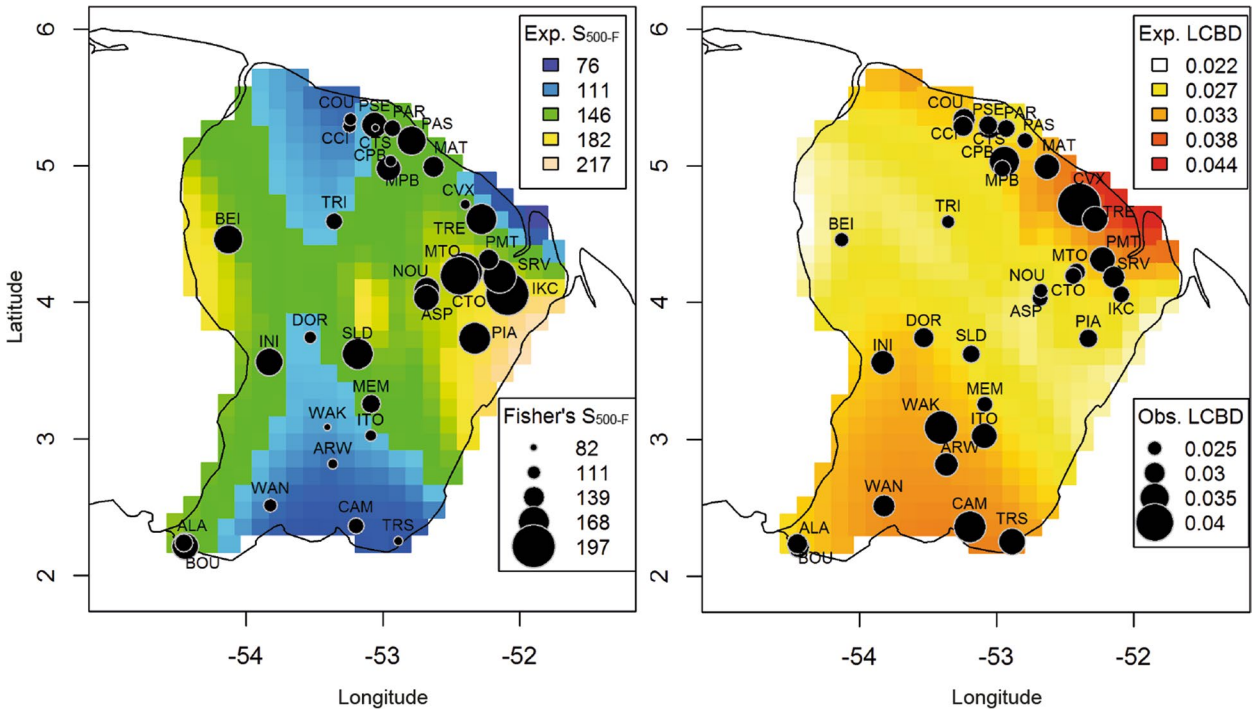


Fig. 5 **a:** Per-site average species richness per plot, after standardising plot density to 500 trees (Fisher's $S_{500\text{-}F}$) and its LOESS-based expectation (Exp. $S_{500\text{-}F}$) across French Guiana; **b:** Average observed Local Contribution to Beta Diversity (Obs. LCBD) at the site level and its LOESS-based expectation (Exp. LCBD) across French Guiana. Dataset: all the GUYADIV inventory data with dbh ≥ 10 cm. Variance explained by both LOESS models: 61%

Other forest inventory networks in French Guiana, such as GUYAFOR (Mirabel et al. 2025) and RedGentry (Baraloto et al. 2021; Draper et al. 2021), provide complementary sources of information to consider when assessing future priorities for forest inventories.

GUYAFOR is a network of permanent forest plots covering more than 300 ha across 18 sites, including relatively large plots (4–6.25 ha on average). It includes both long-established sites also represented in GUYADIV, such as Paracou (PAR; 118 ha inventoried in GUYAFOR), Rivière Arataye–Saut Pararé (ASP) and the Nouragues research stations (NOU; 22 ha in GUYAFOR), and more recently established plots at sites not represented in GUYADIV. All GUYAFOR sites are located in the northern half of French Guiana and include complementary forest types, such as white-sand forests in the west. GUYAFOR plots primarily support long-term studies of forest dynamics and aboveground carbon biomass, and have a more variable and overall much lower level of botanical identification than GUYADIV.

RedGentry is an international network of plots surveyed using A. Gentry's nested-plot method, with a 2.5 cm dbh threshold, and includes 102 0.1-ha plots inventoried in 10 subregions in French Guiana. Like GUYADIV, it is dedicated to documenting tree species diversity and has a broadly comparable level of botanical identification. RedGentry plots in French Guiana overlap with GUYADIV at several sites, including Monts Tumuc-Humac–Crique Alama (ALA) and Mont Itoupé (ITO), but provide complementary sampling of typical French Guianan forest habitats, particularly bottomlands, white-sand forests and inselbergs.

6.2 Floristic coverage and sampling effort

The species accumulation curves illustrate both the substantial tree species richness captured by the GUYADIV dataset and the sampling effort still required to further document the tree flora of French Guiana (Fig. 6). A total of 1,393 tree species are recorded in GUYADIV, representing approximately 70% of the 1,668 validly named species listed in the checklist of tree species of French Guiana (Molino et al. 2022). However, the species accumulation curve for the complete dataset continues to increase without reaching an asymptote, indicating that the current sampling remains incomplete. This is consistent with the estimate of approximately 2,200 tree species proposed by Marcon et al. (2024), while the log-series model fitted to the abundance distribution of the French Guianan tree flora predicts a substantially larger total of 4,368 species (Marcon et al. 2024).

The species accumulation curves also reveal marked differences in species accumulation among regions

(Fig. 6b–d). The north-eastern quarter contains substantially more recorded species than the central-southern zone, but this difference is partly attributable to the much greater sampling effort in the north-east (Fig. 6b). To control for this difference, we compared the central-southern zone with balanced resampling of the north-eastern subset (Fig. 6c–d). At comparable sampling effort, the north-eastern subset still accumulates species more rapidly and reaches higher richness than the central-southern zone, indicating that the north-eastern quarter supports a particularly high tree species richness. The more rapid accumulation of species in the north-east may also reflect greater compositional heterogeneity among sampling sites, as additional plots contribute species that are absent from previously sampled plots.

These results indicate that the sampling effort required to document tree diversity is likely to vary substantially across French Guiana. The species accumulation curves therefore provide a useful basis for evaluating the expected gain from additional inventories and for identifying regions where further sampling is likely to yield substantial numbers of previously unrecorded species. In this sense, they complement the spatial diversity patterns presented above by providing an empirical basis for estimating not only where additional plots may be most informative, but also how much sampling effort may be required to approach a more complete description of the tree flora.

6.3 Seasonal timing of inventories and phenology

The high proportion of trees observed at sterile stage is noteworthy, as 78.3% of trees with a dbh $\geq$ 10 cm were observed during periods known to be those of flowering and fruiting at the community level (February–April and August–November; Sabatier 1985) (Fig. 7). However, when calculated at the observation level rather than at the individual-tree level, the proportion of fertile trees is similar in both cases (2.1% for GUYADIV versus

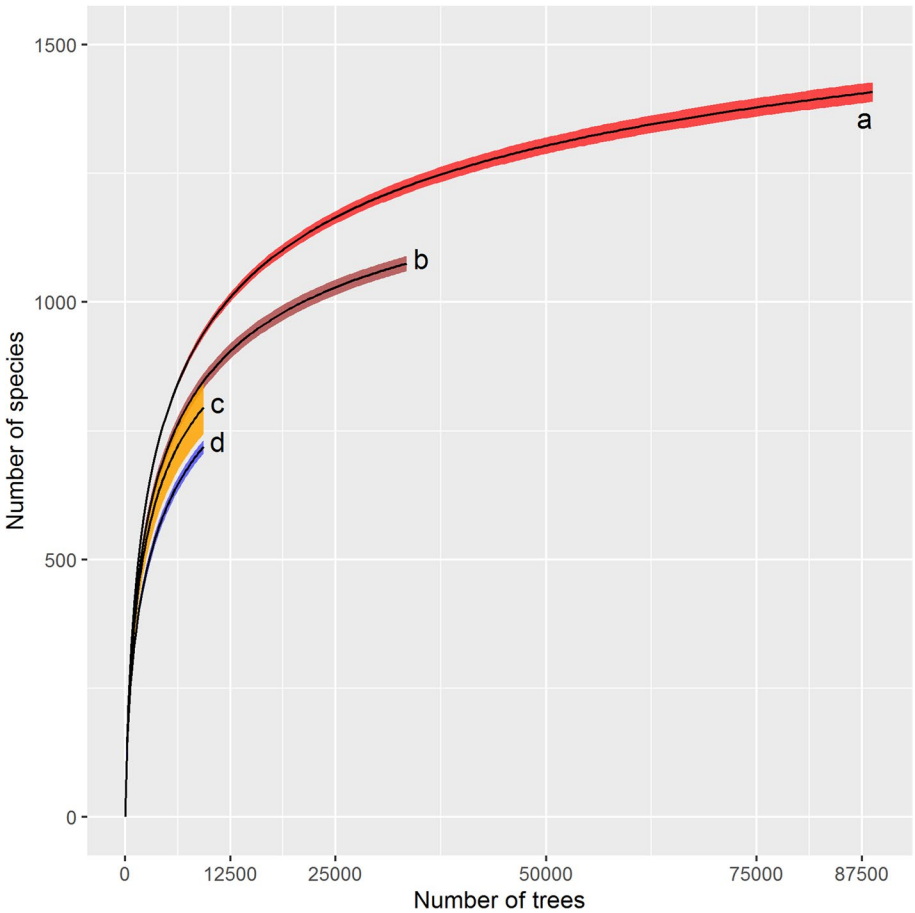


Fig. 6 Species accumulation curves with a 95% confidence interval for: a) the complete GUYADIV dataset; b) the entire north-eastern quarter subset; c) balanced resampling of the north-eastern quarter subset (n = 110, average ± 2 SD); and d) the central-southern zone subset. SAC were computed in R (R Core Team 2023) using the Vegan (Oksanen et al. 2025) package, with 95% confidence intervals estimated using the Entropy Estimation method (Cao and Grabchak 2024)

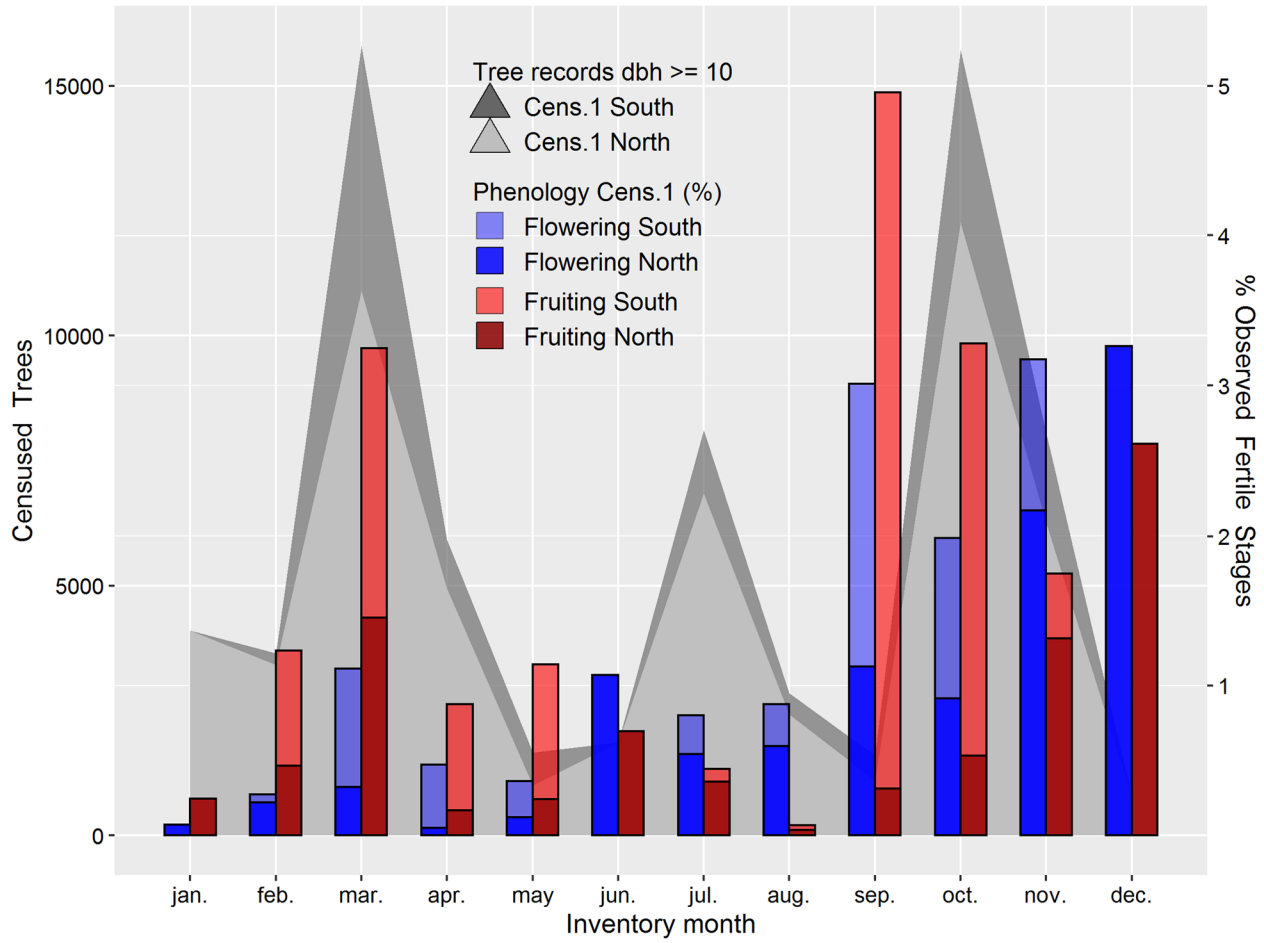


Fig. 7 Number of trees with dbh ≥ 10 cm recorded during each inventory month in the northern and southern halves of French Guiana (separated by latitude 3.7°) during the first census (Cens.1), and proportion of trees observed in flowering or fruiting stages (immature or ripe fruit) during this census

1.6–2.0% in Sabatier 1985). This suggests that the low proportion of fertile trees in GUYADIV is not simply due to inventories being conducted outside the main community-level reproductive periods.

Only the initial censuses of the northern half of French Guiana (latitude > 3.7°) provide a relatively complete, although irregular, temporal coverage across the year (Fig. 7). This uneven temporal coverage limits the ability to assess seasonal patterns in fertility and highlights opportunities for targeted revisits.

To maximise the probability to get fertile material, we recommend establishing new plots during the main dry season (from September to early December). March (which corresponds to the short dry season) also appears to be a favourable time for harvesting fruit. In order to try to obtain fertile material from poorly documented or unidentified species listed in the GUYADIV database, we recommend visiting the GUYADIV plots to supplement the current temporal coverage, which mainly involves visiting them during the rainy season.

7 Conclusion

Although its asynchronous nature and the lack of continuous monitoring limit its use for studying short-term forest dynamics, the extensive spatial coverage and taxonomic accuracy of the GUYADIV dataset provide a remarkable baseline for research on tropical tree diversity and community assembly. Given the very low sampling effort in tropical forests, this dataset also provides a valuable basis for optimising future inventories in French Guiana by highlighting priority areas for exploration — particularly in southern and north-eastern French Guiana — and by helping to identify the most suitable periods for collecting fertile specimens.

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In memoriam

During the lengthy period required to complete the GUYADIV inventories, several of our colleagues sadly passed away. We wish to honor their memory and acknowledge their importance to us: Georges Elfort, Charles François, Jean-Marc Guehl, Christian de Namur, Marie-Françoise Prévost.

We dedicate this work to our dear friend and colleague Marie-Françoise 'Fanchon' Prévost (1941–2013), who played a major role in the constitution of this dataset, and to our highly esteemed colleague and forest guide Georges Elfort (1939–2022), who guided us through forests and rivers for so many years.

Authors' contributions

JFM initiated the publication project, prepared the first version of the dataset, and wrote the original draft; JE coordinated the project and the subsequent preparation and revision of the manuscript; JE, JFM, DS and LB corrected the data and finalised the dataset; DS, DL and LB performed the analyses; DS, JE, JFM, LB and HTS wrote the final draft; RP, VF, LiB, OF, PB, GO and CM provided useful comments and suggestions; all authors (except DL and LB) contributed to the field data (see details in the 'contributors' table), had the opportunity to comment on and edit the article, and gave their final approval for publication.

Data availability

The GUYADIV dataset is available in the IRD DataSuds repository: https://doi.org/10.23708/RLYCVQ. The associated metadata are available at https://metadata-afs.nancy.inra.fr/geonetwork/srv/fre/catalog.search#/metadata/da2fb3a7-8669-499d-b8c1-258da68b8f85. Georeferenced shape files of the plots are available in the IRD DataSuds repository: https://doi.org/10.23708/T2UC4M.

Declarations

Competing interests

The authors declare no competing interests.

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