

***Mauritia flexuosa* (Buriti) forest description: hydro-edaphic effects on tree species distribution in western Amazon**

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Abstract: This study addresses the lack of knowledge about the buritizais of the western Brazilian Amazon, filling critical gaps for their conservation and management. Buritizais -permanently flooded palm forests dominated by *Mauritia flexuosa*- are widespread but rarely described in ecological inventories. These formations are key components of wetland mosaics, influencing carbon storage and local hydrology. Conducted in the Javari-Buriti Area of Relevant Ecological Interest, the study aimed to (i) describe floristic composition and forest structure, (ii) evaluate variation along hydro-edaphic gradients, and (iii) identify environmental factors most strongly associated with *M. flexuosa* distribution. A floristic inventory was carried out in three sampling areas (T1, T2, T3), and statistical analyses, including Canonical Correspondence Analysis (CCA) and a regression tree, were used to assess vegetation–environment relationships. Two main phytophysiognomies were distinguished: *várzea alta* (T1) and *buritizal* (T3), with T2 representing a transition. This differentiation was driven by soil attributes and flooding. *M. flexuosa* was associated with high organic-matter and phosphorus contents and longer inundation, whereas species such as *Carapa guianensis* and *Zygia latifolia* occurred in less flooded areas. These findings highlight the ecological importance of the ARIE Javari-Buriti and the need to consider habitat heterogeneity in conservation strategies.

Keywords: Edaphic parameters; flooded forests; tropical palm; vegetation–environment interrelationships; vegetation structure.

Descrição de floresta de *Mauritia flexuosa* (Buriti): efeitos hidroedáficos na distribuição de espécies arbóreas na Amazônia ocidental

Resumo: Este estudo aborda a lacuna de conhecimento sobre os buritizais da Amazônia brasileira ocidental, preenchendo informações essenciais para sua conservação e manejo. Os buritizais -florestas permanentemente inundadas dominadas por *Mauritia flexuosa*- são amplamente distribuídos, mas raramente descritos em inventários ecológicos. Essas formações são componentes-chave dos mosaicos de áreas úmidas, influenciando o armazenamento de carbono e a hidrologia local. Realizado na Área de Relevante Interesse Ecológico Javari-Buriti, o estudo teve como objetivos: (i) descrever a composição florística e a estrutura da floresta; (ii) avaliar a variação ao longo de gradientes hidroedáficos; e (iii) identificar os fatores ambientais mais fortemente associados à distribuição de *M. flexuosa*. Um inventário florístico foi conduzido em três áreas de amostragem (T1, T2 e T3), e análises estatísticas, incluindo Análise de Correspondência Canônica (CCA) e árvore de regressão, foram aplicadas para avaliar as relações entre vegetação e ambiente. Duas principais fitofisionomias foram distinguidas: *várzea alta* (T1) e *buritizal* (T3), com T2 representando uma zona de transição. Essa diferenciação foi determinada por atributos do solo e pela inundação. *M. flexuosa* esteve associada a maiores teores de matéria orgânica e fósforo e a períodos mais longos de inundação, enquanto espécies como *Carapa guianensis* e *Zygia latifolia* ocorreram em áreas menos inundadas. Esses resultados ressaltam a importância ecológica da ARIE Javari-Buriti e a necessidade de considerar a heterogeneidade de habitats nas estratégias de conservação.

Palavras-chave: Estrutura da vegetação; florestas inundadas; inter-relações vegetação-ambiente; palmeira tropical; parâmetros edáficos.

Introduction

The high species diversity of the Amazon rainforest is shaped by stable environmental conditions and habitat heterogeneity, with an estimated 14,000 tree species occurring in the region (Cardoso et al. 2017; Luize et al. 2018; Ter Steege et al. 2020). These habitats include both non-flooded forests, such as *terra firme*, and seasonally flooded forests, such as *igapós* and *várzeas*, which are inundated by black or crystalline water (*igapós*) and white water (*várzeas*) (Ayres 1995; Junk et al. 2011). Hydrological dynamics play a crucial role in shaping plant species distribution by influencing factors such as nutrient availability, soil physicochemical properties, and species tolerance to flooding (Casanova and Brock 2000; Engelbrecht et al. 2007; Junk et al. 2011).

Wetlands in the Amazon Basin cover up to one-third of the total area and contribute to a highly heterogeneous landscape, promoting endemism and supporting the most diverse wetland flora in the world (Kubitzki 1989; Hess 2003; Hamilton et al. 2007; Wittmann et al. 2006, 2013). However, while research has largely focused on seasonally flooded environments, such as *várzeas* and *igapós*, permanently flooded areas remain understudied despite their ecological significance. This view is consistent with Brazilian wetland definitions and classifications that emphasize the functional diversity of flood types and explicitly discuss *Mauritia flexuosa* palm swamps within national contexts (e.g., Junk et al., 2014). These ecosystems are increasingly recognized for their role in global carbon dynamics (Lähteenoja et al. 2012), biodiversity conservation (Brightsmith and Bravo 2006; Householder et al. 2010; Marshall et al. 2011), and local hydrological processes (Kelly et al. 2014).

Among the permanently flooded ecosystems, *buritizais*—vegetation formations dominated by the palm *Mauritia flexuosa* L.f.—are widely distributed across the Amazon Basin, particularly in hydromorphic soils (Spruce 1871; Junk and Furch 1993; Householder et al. 2012). Despite their vast extent and ecological importance, *buritizais* are paradoxically among the least studied Amazonian ecosystems and are often excluded from forest inventories. Extrapolated analyses from ter Steege et al. (2013) estimate that *buritizais* occupy 2–3 million hectares in the Amazon, harboring approximately 1.5 billion individuals of *M. flexuosa*. These formations may occur in dispersed patches within *terra firme* or seasonally flooded forests (Householder et al. 2012), but the environmental factors driving their distribution remain largely unknown. Tropical palms play keystone roles in Neotropical wetlands by structuring habitats, subsidizing food webs, and mediating water and carbon dynamics (Kahn & Mejia, 1990; Pintaud et al., 2008; Virapongse et al., 2017). In floodplain landscapes, palm-dominated stands can influence light availability, litter inputs, and soil redox conditions, with cascading effects on recruitment and species turnover (Householder et al., 2012; Wittmann et al., 2013). At the same time, these systems face increasing pressures from drainage, fire leakage during droughts, unsustainable harvest, and land-use change along hydrological corridors (Kahn & Granville, 1992; Junk et al., 2011; Virapongse et al., 2017). Because palm dominance can both reflect and reinforce hydro-edaphic constraints, documenting how environmental gradients relate to community structure in palm swamps is essential for conservation planning and for anticipating responses to altered flood regimes.

One of the largest known *buritizal* formations is located in the Javari-Buriti Area of Relevant Ecological Interest (ARIE Javari-Buriti), in the western Amazon. This protected area was established

to safeguard *M. flexuosa* forests and their associated fauna. However, despite its ecological relevance, ARIE Javari-Buriti remains one of the least studied conservation units in the Brazilian Amazon, with little information available on its floristic composition or the environmental gradients influencing its vegetation structure.

In this context, this study aimed to characterize the vegetation of ARIE Javari-Buriti and investigate the environmental factors that influence its structure and floristic composition. The research specifically addressed the following questions: (i) What are the floristic composition and structural organization of the forest in ARIE Javari-Buriti, and how do these attributes vary along hydro-edaphic gradients?

(ii) Which environmental factors are most strongly associated with the distribution of *Mauritia flexuosa*? These analyses contribute to filling critical knowledge gaps regarding permanently flooded Amazonian areas and provide essential insights for the conservation and management of ARIE Javari-Buriti.

Material and Methods

1. Study area

The ARIE Javari-Buriti was established by Decree No. 91.886 of November 5, 1985 (Brasil 1985). It is located in the *Solimões* River Basin, in the municipality of *Santo Antônio do Içá*, Amazonas State, Brazil (Figure 1). The reserve spans 13,177.22 hectares and aims to protect *buriti* palm forests and associated fauna. It is accessible by river along its northern boundary, situated on the right bank of the *Solimões* River from 02°59'S 67°49'W to 03°01'S 67°51'W. The southern and eastern sections are only accessible by land via extensive forested areas (Fleischmann et al. 2023). The regional climate is classified as Af (humid tropical rainforest) according to the Köppen system, characterized by an absence of a dry season, annual precipitation ranging from 2,800 to 3,100 mm, and average temperatures between 24 and 26°C (Alvares et al. 2013a, 2013b).

Hydrography and administrative boundaries shapefiles were obtained from the Brazilian Institute of Geography and Statistics (IBGE 2019a, 2019b). The georeferenced boundary of ARIE Javari-Buriti was provided by ICMBio.

2. Floristic structure

2.1. Forest inventory

The study employed a stratified conglomerate sampling design (Magnussen et al. 2001; Sanquetta et al. 2014) to ensure comprehensive coverage of vegetation heterogeneity within ARIE Javari-Buriti. The stratification considered the main hydro-edaphic gradient of the area, represented by differences in soil characteristics and flooding intensity. Three transects were established (T1, T2, and T3), each 600 m in length, positioned to capture this gradient from less- to more-flooded areas. Within each transect, two conglomerates were set up: one located 200 m to the east and another 600 m to the west. Each conglomerate consisted of four 25 × 25 m temporary plots, spaced 50 m apart, yielding a total sampling area of 0.5 ha per transect (8 plots) and 1.5 ha across the study area (24 plots – Figure 1C). A schematic representation of the sampling layout, including transects, conglomerates, and plots, is provided in the Electronic Appendix (Figure S1).

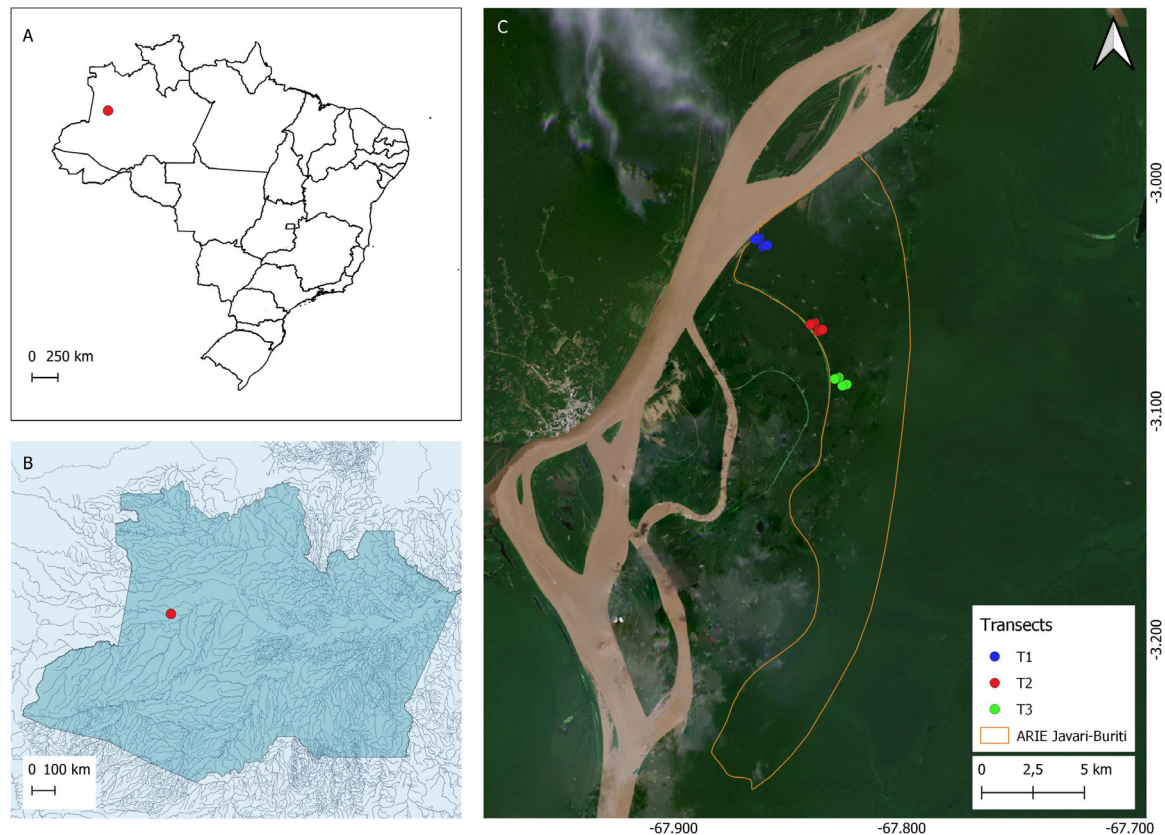


Figure 1. Cartographic representation map, highlighting the location of the ARIE Javari-Buriti in Brazil (A), in the Amazonas State, with a presentation of the hydrography (B), and a more detailed view of the polygon of the area, with the points of the transects ([C] T1, T2 and T3) used for the survey. In yellow, the boundary of the ARIE Javari-Buriti on the banks of the *Solimões* River. Google Satellite, satellite image obtained in February 2025.

Within each plot, all trees and palms with a diameter at breast height (DBH) ≥ 10 cm were sampled. Species were identified in the field by parobotanists, trained technicians specialized in local flora identification and collection under supervision of professional botanists. When field identification was not possible, botanical samples, including fertile (flowers and fruits) and sterile specimens, were collected and dried for later determination by specialists. Species nomenclature was verified against Flora e Funga do Brasil (Flora e Funga do Brasil 2022).

2.2. Vegetation diversity and structure

Vegetation parameters were calculated for each transect, including basal area, density, absolute frequency, dominance, and the Importance Value Index (IV), following the methodology of Müller-Dombois and Ellenberg (1974). Floristic diversity was assessed using Species Richness and Shannon-Wiener (H') indices (Brower and Zar 1984; Perkins 1982), while community evenness was evaluated with Pielou's Equitability Index (J') (Magurran 1988). All parameters and analyses were conducted in R (R Development Core Team 2021) using the packages *ecolTest* (Salinas and Ramirez-Delgado 2021) and *vegan* (Oksanen et al. 2022).

Species were examined in relation to their known habitat preferences (e.g., *várzea alta*, *buritizal*). However, detailed habitat information was available for only a subset of species in the literature. Therefore, we highlighted in the Discussion the main taxa typically associated with

each environment, while generalist and poorly documented species were not classified.

3. Environmental variables

3.1. Soil sampling and analysis

Soil samples were collected from all temporary plots at a depth of 0–20 cm. A single sample was obtained from the center of each plot, covering the range of environmental conditions across the three transects (T1–T3).

The analyzed soil chemical parameters included pH, phosphorus (P), potassium (K), sodium (Na), calcium (Ca), magnesium (Mg), aluminum (Al), potential acidity ($H+Al$), sum of bases (SB), cation exchange capacity (CEC), base saturation (V%), aluminum saturation (m%), and micronutrients (Fe, Zn, Cu, Mn). Organic matter parameters included total carbon/nitrogen ratio (C/N), total organic carbon, and organic matter (OM). Physical parameters included total sand, silt, and clay content (texture analysis).

Soil analyses were conducted by the Soil and Plant Laboratory (LSP) of *Embrapa Amazônia Oriental*, following Teixeira et al. (2017). In some T3 plots, the amount of soil material was insufficient to complete all physical analyses. To avoid missing data, clay content for these plots was complemented using SoilGrids 2.0 at 250 m spatial resolution (Poggio et al. 2021). Clay values extracted from SoilGrids were adjusted

through a linear regression with the field-measured clay data for the remaining plots ($r = 0.68$), as detailed in Supplementary Material S2 (tab Phys (B)). Only clay was used as a physical soil attribute in subsequent analyses because it showed the strongest relationship with the measured texture fractions and best represented the physical gradient among plots. Sand content was determined using a 0.212 mm mesh sieve, while silt and clay were quantified via the pipette method, based on sedimentation time. Phosphorus was measured using spectrophotometry, while cations (Ca, Mg, K, Na, Al) and micronutrients (Fe, Zn, Mn, Cu) were determined via atomic absorption spectrometry (Anderson and Ingram 1993). Carbon and nitrogen contents were estimated with an elemental analyzer (Pella 1990), and organic matter was quantified by the difference between soil dry mass and the residue after incineration (Pereira et al. 2006).

3.2. Flooding

Flooding duration was inferred by comparing historical water surface permanence with plot elevations. Hydrological data were obtained from the *Santo Antônio do Içá* fluvimetric station (Hidroweb Code 11.500.000), and elevation data were sourced from the Digital Terrain Model *Cartografia da Amazônia* (Correia 2011) at a 5-meter spatial resolution. Water level measurements were recorded using local topographic rulers and converted to match the digital model's vertical reference. A zero-level reference of 43.15 m was adopted based on Moreira (2016). The number of days of flooding per year was estimated by calculating the average number of days on which the plot elevation was below the water surface. The study area is characterized by a seasonal flooding regime associated with the hydrological cycle of the Solimões River and its tributaries. Water levels begin to rise between December and February, reaching their peak from April to June, and receding from August to October. Flooding intensity was estimated using data from the nearest fluvimetric station, corresponding to the number of flooded days per year for each plot (Supplementary Material S2; Figure S2 in the Electronic Appendix). The number of flooded days ranged from 73 to 140 days year⁻¹, indicating a clear hydrological gradient, with less flooded transects (T2) and more flooded ones (T1 and MaT3).

3.3. Statistical analysis

To analyze vegetation–environment relationships, we combined correlation analyses, univariate tests, and multivariate ordination. All statistical analyses were based on plot-level matrices of environmental variables (Supplementary Material S2; tabs Chem (A), Phys (B), and Flood (C)) and tree species abundance (Supplementary Material S2; tab Abundance (D)). Environmental variables (soil parameters and flooding duration) were correlated with tree species abundance in the sampled plots. To minimize multicollinearity, a stepwise variance inflation factor (VIF) selection was performed (Graham 2003). Variables were retained based on a threshold VIF < 6. The VIF values for all candidate variables and the subset retained for analysis are presented in Supplementary Material S1 (tab VIF (A)). This analysis was conducted using the *HH* package in R (Graham 2003).

Prior to comparing environmental variables among transects, we tested each variable for normality using the Shapiro–Wilk test. Variables with normal distributions were analyzed with one-way ANOVA followed by Tukey's post-hoc test, whereas non-normal variables were

analyzed using the Kruskal–Wallis test followed by Dunn's post-hoc comparisons. All variables used in these tests are listed in Supplementary Material S2 (tabs Chem (A), Phys (B), and Flood (C)). Differences in environmental variables across sampling areas (transects) were assessed using ANOVA with Tukey's post-hoc test for normally distributed data and Kruskal–Wallis with Dunn's test for non-normal distributions. These tests were performed using the *Agricolae* (Mendiburu 2023) and *dunn.test* (Dinno 2017) packages in R. Boxplots were generated with *ggplot2* (Wickham 2016) and *gridExtra* (Auguie 2017) packages.

Species composition was analyzed using non-metric multidimensional scaling (NMDS) based on Bray–Curtis dissimilarity. Differences in species composition among flooding categories were tested using PERMANOVA on Bray–Curtis distances, complementing the NMDS ordination. All analyses were performed in R (R Core Team 2021) using the package *vegan* (Oksanen et al. 2022).

Canonical Correspondence Analysis (CCA) was applied to assess species composition variation along environmental gradients, using the *vegan* package (Oksanen et al. 2018). The analysis used the plot-level species abundance data (Supplementary Material S2, tab Abundance (D)) and the environmental variables retained after multicollinearity screening (Supplementary Material S1, tab VIF (A)). Rare species were downweighted, and transect was included as a conditioning variable to account for spatial structure. The function *envfit* was used to fit environmental vectors onto the ordination and to test their significance by permutation (999 permutations), and Monte Carlo tests were used to assess axis significance (Ter Braak 1986, 1987, 1988).

Ordination histograms were constructed to visualize how the abundance of selected species varied along the main environmental gradients identified by the CCA. Species included in histograms were selected based on CCA significance. This analysis utilized the *poncho* function (Dambros 2020) in R. In the main text we present only the histogram for the most influential environmental variable, whereas additional histograms are provided in the Electronic Appendix.

A Classification and Regression Tree (CART) analysis was conducted to identify key factors influencing buriti (*M. flexuosa*) abundance, using the *rpart* (Therneau 2017) and *part.plot* (Milborrow 2018) packages. This non-parametric approach recursively partitions data into homogenous groups defined by explanatory variables, facilitating interpretation of species–environment relationships.

Results

4. Floristic structure

4.1. Composition

A total of 112 morphospecies were recorded among the 816 individuals sampled across the 24 plots. Of these, 81 were identified at the species level, 19 at the genus level, one at the family level, and 11 remained unidentified (Table 1). The complete dataset, including DBH, estimated height, and other relevant attributes for all sampled individuals, is available at the SciELO Data repository: <https://doi.org/10.48331/SCIELODATA.RIVAW4> (draft version).

The most species-rich genera were *Inga* (seven species, five unidentified at the species level), *Eschweilera* (five species), and *Ficus* (four species). Together, these three genera accounted for 14.3% of all

Table 1. List of families and species recorded in the floristic survey of the study area. ARIE Javari-Buriti, Amazonas State, Brazil.

Family	Species	Vernacular name
Anacardiaceae	<i>Spondias mombin</i> L.	Taperebá
Anacardiaceae	<i>Tapirira guianensis</i> Aubl.	
Annonaceae	<i>Duguetia</i> sp.1	Envira preta
Annonaceae	<i>Guatteria citriodora</i> Ducke	Envira amargosa
Annonaceae	<i>Pseudoxandra</i> sp.1	Brinco de moça
Apocynaceae	<i>Aspidosperma rigidum</i> Rusby	Carapanaúba
Apocynaceae	<i>Himatanthus articulatus</i> (Vahl) Woodson	Sucuúba
Apocynaceae	<i>Lacmellea gracilis</i> (Müll. Arg.) Markgr.	Siricutico
Apocynaceae	<i>Malouetia tamaquarina</i> (Aubl.) A.DC.	Molongó
Arecaceae	<i>Astrocaryum jauari</i> Mart.	Jauari
Arecaceae	<i>Astrocaryum murumuru</i> Mart.	Murumuru
Arecaceae	<i>Attalea phalerata</i> (Mart.) ex Spreng	Urucuri
Arecaceae	<i>Euterpe precatoria</i> Mart.	Açaí
Arecaceae	<i>Mauritia flexuosa</i> L.f.	Buriti
Arecaceae	<i>Mauritiella armata</i> (Mart.) Burret	Buritirana
Arecaceae	<i>Oenocarpus bacaba</i> Mart.	Bacaba
Arecaceae	<i>Socratea exorrhiza</i> (Mart.) H.Wendl.	Paxiúba
Burseraceae	<i>Protium</i> sp.1	Breu branco
Burseraceae	<i>Protium</i> sp.2	
Chrysobalanaceae	<i>Licania impressa</i> Prance	Uixi liso
Chrysobalanaceae	<i>Licania</i> sp.1	
Clusiaceae	<i>Garcinia brasiliensis</i> Mart.	Bacuri liso
Clusiaceae	<i>Symphonia globulifera</i> L.f.	Paxiúba amarela
Combretaceae	<i>Terminalia dichotoma</i> G.Mey.	Tanimbuca baratinha
Dichapetalaceae	<i>Tapura juruana</i> (Ule) Rizzini	Quineira
Elaeocarpaceae	<i>Sloanea guianensis</i> (Aubl.) Benth.	Urucurana vermelha
Elaeocarpaceae	<i>Sloanea</i> sp.1	Urucurana vermelha
Erythroxylaceae	<i>Erythroxylum kapplerianum</i> Peyr.	Socoró, cocarana-branca
Euphorbiaceae	<i>Alchornea discolor</i> Poepp.	Supiarana
Euphorbiaceae	<i>Anomalocalyx uleanus</i> (Pax & K.Hoffm.) Ducke	
Euphorbiaceae	<i>Conceveiba</i> sp.1	
Euphorbiaceae	<i>Hevea spruceana</i> (Benth.) Müll.Arg.	Seringa barriguda
Euphorbiaceae	<i>Hura crepitans</i> L.	Assacu
Euphorbiaceae	<i>Mabea nitida</i> Spruce ex Benth.	Seringai
Euphorbiaceae	<i>Pinharea trifoliata</i> Baill.	Piranheira

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Family	Species	Vernacular name
Euphorbiaceae	<i>Sapium glandulosum</i> (L.) Morong	Murupita
Fabaceae	<i>Crudia glaberrima</i> (Steud.) J.F.Macbr.	Ingá xixica
Fabaceae	Indet2	Mututi branco
Fabaceae	<i>Inga ingoides</i> (Rich.) Willd.	Ingá do folhão
Fabaceae	<i>Inga pilosula</i> (Rich.) J.F.Macbr.	Ingá 2
Fabaceae	<i>Inga</i> sp.1	Ingá corrente
Fabaceae	<i>Inga</i> sp.2	Ingá xixaua
Fabaceae	<i>Inga</i> sp.3	Ingá peluda
Fabaceae	<i>Inga</i> sp.4	Ingá ferro
Fabaceae	<i>Inga</i> sp.5	Ingá açú
Fabaceae	<i>Lecointea amazonica</i> Ducke	Paracuuba
Fabaceae	<i>Macrolobium bifolium</i> (Aubl.) Pers.	Cedrinho pata de vaca
Fabaceae	<i>Ormosia macrocalyx</i> Ducke	Tento vermelho
Fabaceae	<i>Ormosia towarensis</i> Pittier	Tento flamenguista
Fabaceae	<i>Pterocarpus amazonum</i> (Benth.) Amshoff	Tachi branco
Fabaceae	<i>Pterocarpus santalinoides</i> L'Hér. ex DC.	Ingá chato
Fabaceae	<i>Pterocarpus</i> sp.1	Mututi
Fabaceae	<i>Taralea oppositifolia</i> Aubl.	Cumaru-amarelo
Fabaceae	<i>Vouacapoua americana</i> Aubl.	Faveira
Fabaceae	<i>Zygia coccinea</i> (G.Don) L.Rico	Ingá
Fabaceae	<i>Zygia latifolia</i> (L.) Fawc. & Rendle	Ingá de anta
Fabaceae	<i>Zygia trunciflora</i> (Ducke) L.Rico	Ingá chato
Hypericaceae	<i>Vismia sandwithii</i> Ewan	Lacre
Lamiaceae	<i>Aegiphila</i> sp.1	Supiarana
Lauraceae	<i>Nectandra amazonum</i> Nees	Cachimbo, louro chumbo
Lauraceae	<i>Ocotea</i> sp.1	Louro chumbo
Lauraceae	<i>Ocotea splendens</i> (Meisn.) Baill.	Louro
Lecythidaceae	<i>Couropita subsessilis</i> Pilg.	Macacarecuia
Lecythidaceae	<i>Eschweilera albiflora</i> (DC.) Miers	Matá matá folha graúda
Lecythidaceae	<i>Eschweilera ovalifolia</i> (DC.) Nied.	Castanharana
Lecythidaceae	<i>Eschweilera parvifolia</i> Mart. ex DC.	Ripeira
Lecythidaceae	<i>Eschweilera rionegrense</i> S.A.Mori	

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Family	Species	Vernacular name
Lecythidaceae	<i>Eschweilera tenuifolia</i> (O.Berg) Miers	Matá matá
Lecythidaceae	<i>Gustavia poeppigiana</i> O.Berg	Cachimbo
Malvaceae	<i>Apeiba glabra</i> Aubl.	Bolacheira
Malvaceae	<i>Apeiba tibourbou</i> Aubl.	Caibreiro
Malvaceae	<i>Ceiba pentandra</i> (L.) Gaertn.	Samaúma
Malvaceae	<i>Pachira insignis</i> (Sw.) Sw. ex Savigny	Mungubarana
Malvaceae	<i>Pseudobombax munguba</i> (Mart.) Dugand	Munguba
Malvaceae	<i>Sterculia apetala</i> (Jacq.) H.Karst.	Tacacá
Melastomataceae	<i>Mouriri grandiflora</i> DC.	Araçapéua
Meliaceae	<i>Carapa guianensis</i> Aubl.	Andiroba
Meliaceae	<i>Carapa vasquezii</i> Kenfack	Andirobinha
Meliaceae	<i>Trichilia pallida</i> Sw.	Murici
Meliaceae	<i>Trichilia rubra</i> C.DC.	Envira fofa
Meliaceae	<i>Trichilia solitudinis</i> Harms	
Moraceae	<i>Brosimum acutifolium</i> Huber	Mururé
Moraceae	<i>Ficus adhatodifolia</i> Schott in Spreng.	Caxinguba
Moraceae	<i>Ficus maxima</i> Mill.	Caxinguba
Moraceae	<i>Ficus paraensis</i> (Miq.) Miq.	Apuí-amarelo
Moraceae	<i>Ficus</i> sp.1	Apuí
Moraceae	<i>Maquira coriacea</i> (H.Karst.) C.C.Berg	Muiratinga
Myristicaceae	<i>Virola surinamensis</i> (Rol. ex Rottb.) Warb.	Ucuúba
Myrtaceae	<i>Eugenia</i> sp.1	Araçapéua
Olacaceae	<i>Heisteria acuminata</i> (Humb. & Bonpl.) Engl.	Brinco de moça
Olacaceae	<i>Miquartia guianensis</i> Aubl.	Acariquara
Phyllanthaceae	<i>Discocarpus essequiboensis</i> Klotzsch	Mututi
Polygonaceae	<i>Triplaris weigeltiana</i> (Rchb.) Kuntze	Tachi vermelho
Rubiaceae	<i>Sickingia tinctoria</i> (Benth.) Bremek. ex Steyerl.	Pau rosa
Sapotaceae	<i>Chromolucuma rubriflora</i> Ducke	Abiurana-grande-de-igapó
Sapotaceae	<i>Pouteria rostrata</i> (Huber) Baehni	Abiurana-seringa
Sapotaceae	<i>Pouteria</i> sp.1	
Sapotaceae	<i>Pouteria</i> sp.2	
Urticaceae	<i>Cecropia latiloba</i> Miq.	Embaúba roxa

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Family	Species	Vernacular name
Urticaceae	<i>Cecropia membranacea</i> Trécul	Embaúba branca
Violaceae	<i>Leonia glycyarpa</i> Ruiz & Pav.	Catoré branco
Indet	Indet	Cipó
Indet1	Indet1	Envira fofa
Indet3	Indet3	
Indet4	Indet4	
Indet5	Indet5	Canela de velho
Indet6	Indet6	
Indet7	Indet7	
Indet8	Indet8	Capitiú
Indet9	Indet9	Gitó amarelo
Indet10	Indet10	
Indet11	Indet11	

recorded species. In contrast, 54 genera were represented by a single species each, making up 48.2% of the total species richness.

At the family level, *Fabaceae* (21 species), *Arecaceae* (eight species), and *Euphorbiaceae* (eight species) exhibited the highest species richness, collectively contributing 44.6% of the total diversity. These findings suggest that plant diversity is concentrated within a few taxonomic groups. Regarding abundance, *Arecaceae* (287 individuals), *Fabaceae* (62), *Euphorbiaceae* (57), *Lecythidaceae* (28), and *Malvaceae* (28) were the most representative families, comprising 56.6% of the total individuals sampled (see SciELO Data repository: <https://doi.org/10.48331/SCIELODATA.RIVAW4>, draft version). Notably, *Arecaceae* alone accounted for 35% of all sampled individuals, primarily due to the dominance of *Mauritia flexuosa* (135 individuals) and *Euterpe precatoria* (87 individuals), which together represented 27.2% of the sampled trees.

4.2. Vegetation structure and diversity

Significant differences in species richness were observed among the transects. Transect 2 had the highest number of species, with a total of 84, whereas Transect 3 had the lowest richness, with 28 species recorded. Conversely, total stem density was highest in Transects 2 and 3 (Table 2). Basal area did not differ significantly among the areas, ranging from 5.4 to 5.9 m² per hectare (Table 2).

The Shannon-Wiener diversity index and Pielou's evenness index, which measure species distribution uniformity, indicated greater similarity between Transects 1 and 2, while Transect 3 showed a distinct floristic composition (Table 2).

Species density, defined as the number of individuals per unit area, dominance (expressed in terms of basal area), and frequency (species occurrence in sampling units) were used to calculate the Importance Value Index (IV). The species with the highest IV in Transect 1 were *Hura crepitans* (assacú), *Virola surinamensis* (ucuúba), *Euterpe precatoria* (açai), and *Mauritia flexuosa* (buriti). In Transect 2, the

Table 2. Richness values and phytosociological parameters analysed for each transect (T1, T2 and T3) in the study area. ARIE Javari-Buriti, Amazonas State, Brazil.

	T1	T2	T3
Richness	50	84	28
Density*	440 ± 73,54 ind/ha	552 ± 33,94 ind/ha	558 ± 2,83 ind/ha
Basal Area*	22,56 ± 0,06 ind/ha	21,72 ± 2,43 m ² /ha	23,57 ± 0,72 m ² /ha
Shannon-Wiener (H')	3,203387	3,712292	1,952309
Pielou (J)	0,8188568	0,8378347	0,5858911

*Total per area, considering the eight plots installed (= 0.5 ha).

highest IV values were found for *Carapa guianensis* (andiroba), *Euterpe precatoria*, *Hura crepitans*, and *Virola surinamensis* (Table 3).

Transect 3 exhibited a distinct species composition, with *Mauritia flexuosa* ranking highest in both IV and absolute density (116 individuals), followed by *Chromolucuma rubriflora* (70 individuals), *Euterpe precatoria*, and *Anomalocalyx uleanus*. Notably, *Mauritia flexuosa* accounted for 41.4% of all individuals sampled in this transect (Table 3).

A summary of representative tree species typically associated with *várzea alta*, *buritizal*, and generalist environments, based on literature information, is provided in the Supplementary Material S1 (tab “Representative tree species”).

5. Vegetation-environment interrelationships

The complete tables containing the results of the chemical and physical soil analyses, as well as the calculated inundation values and the abundance data of recorded species in each plot, are available on ForestPlots (forestplots.net). Due to insufficient material collected, it was not possible to conduct physical soil analyses for all plots, particularly in T3. To address this limitation, clay concentration data for the 26 plots were extracted from SoilGrids 2.0 (Poggio et al. 2021). The correlation between clay concentrations measured in the laboratory for 16 plots and those extracted from SoilGrids was 0.68, and the resulting regression equation was used to adjust the SoilGrids values for the remaining 10 plots. Consequently, “clay” was the only soil physical attribute considered in subsequent analyses.

After testing for multicollinearity, the following variables were selected for further analysis: pH, organic matter (OM), P, Al, H+Al (potential acidity), V (base saturation index), Zn, Mn, Cu, Clay, and Flood. The final VIF values for these variables are provided in Supplementary Material S1 (A). Significant differences were detected among the three transects (T1, T2, and T3) for at least one pairwise comparison in the following variables: pH, OM, P, Mn, Cu, Clay, and Flood. The most significant parameter was OM ($p < 0.001$), with the highest values observed in T3 plots. In contrast, Al, H+Al, V, and Zn showed no significant differences between transects (Figure 2 and Supplementary Material S1 (B)).

The NMDS ordination based on Bray–Curtis dissimilarity resulted in a stress value of 0.214, indicating that group separation was not

Table 3. Species, number of individuals (N), absolute density (AD), absolute dominance (ADo), absolute frequency (AF) and importance value (IV) in the three study areas (T1, T2 and T3). The table shows only the 20 species with the highest VI values per area. ARIE Javari-Buriti, Amazonas State, Brazil.

	Species	N	AD	ADo	AF	IV	
1	<i>Hura crepitans</i>	22	11,0	1,27	100	11,79	T1
2	<i>Virola surinamensis</i>	29	14,5	1,01	100	11,33	
3	<i>Euterpe precatoria</i>	28	14,0	0,35	100	7,25	
4	<i>Mauritia flexuosa</i>	15	7,5	0,60	100	6,77	
5	<i>Symphonia globulifera</i>	21	10,5	0,41	100	6,57	
6	<i>Hevea spruceana</i>	7	3,5	0,19	100	3,19	
7	<i>Astrocaryum jauari</i>	7	3,5	0,12	100	2,76	
8	<i>Sterculia apetala</i>	8	4,0	0,08	100	2,67	
9	<i>Couroupita subsessilis</i>	5	2,5	0,15	100	2,62	
10	<i>Pterocarpus amazonum</i>	7	3,5	0,08	100	2,51	
11	<i>Attalea phalerata</i>	4	2,0	0,14	100	2,44	
12	<i>Discocarpus essequiboensis</i>	6	3,0	0,14	50	2,21	
13	<i>Pseudobombax munguba</i>	1	0,5	0,20	50	1,81	
14	<i>Terminalia dichotoma</i>	4	2,0	0,03	100	1,79	
15	<i>Triplaris weigeltiana</i>	4	2,0	0,03	100	1,79	
16	<i>Eschweilera parvifolia</i>	3	1,5	0,02	100	1,56	
17	<i>Mauritiella armata</i>	5	2,5	0,05	50	1,53	
18	<i>Macrobium bifolium</i>	2	1,0	0,03	100	1,45	
19	<i>Spondias mombin</i>	2	1,0	0,02	100	1,43	
20	<i>Socratea exorrhiza</i>	1	0,5	0,13	50	1,42	
1	<i>Carapa guianensis</i>	39	19,5	0,57	100	8,81	T2
2	<i>Euterpe precatoria</i>	38	19,0	0,56	100	8,66	
3	<i>Hura crepitans</i>	5	2,5	0,85	100	6,46	
4	<i>Virola surinamensis</i>	14	7,0	0,23	100	3,74	
5	<i>Symphonia globulifera</i>	12	6,0	0,16	50	2,72	
6	<i>Eschweilera ovalifolia</i>	6	3,0	0,19	100	2,55	
7	<i>Socratea exorrhiza</i>	10	5,0	0,07	100	2,30	
8	<i>Sterculia apetala</i>	7	3,5	0,11	100	2,18	
9	<i>Mauritia flexuosa</i>	4	2,0	0,16	50	1,80	
10	<i>Zygia latifolia</i>	6	3,0	0,06	100	1,72	
11	<i>Cecropia latiloba</i>	5	2,5	0,13	50	1,70	
12	<i>Zygia coccinea</i>	8	4,0	0,06	50	1,65	
13	<i>Indet1</i>	3	1,5	0,10	100	1,63	
14	<i>Ficus adhatodifolia</i>	2	1,0	0,12	100	1,59	

Continue...

...Continuation

	Species	N	AD	ADo	AF	IV	
15	<i>Gustavia poeppigiana</i>	4	2,0	0,06	100	1,50	T2
16	<i>Couroupita subsessilis</i>	2	1,0	0,15	50	1,50	
17	<i>Attalea phalerata</i>	3	1,5	0,08	100	1,49	
18	<i>Cecropia membranacea</i>	4	2,0	0,05	100	1,44	
19	<i>Indet4</i>	1	0,5	0,15	50	1,37	
20	<i>Indet5</i>	4	2,0	0,03	100	1,32	
1	<i>Mauritia flexuosa</i>	116	58,0	3,81	100	37,28	T3
2	<i>Chromolucuma rubriflora</i>	70	35,0	0,99	100	15,90	
3	<i>Euterpe precatoria</i>	21	10,5	0,23	100	5,74	
4	<i>Anomalocalyx uleanus</i>	12	6,0	0,15	100	4,25	
5	<i>Virola surinamensis</i>	11	5,5	0,15	100	4,11	
6	<i>Himatanthus articulatus</i>	14	7,0	0,12	50	3,33	
7	<i>Sterculia apetala</i>	4	2,0	0,04	100	2,68	
8	<i>Ficus adhatodifolia</i>	5	2,5	0,18	50	2,60	
9	<i>Brosimum acutifolium</i>	3	1,5	0,07	50	1,71	
10	<i>Cecropia latiloba</i>	4	2,0	0,04	50	1,67	
11	<i>Alchornea discolor</i>	2	1,0	0,02	50	1,32	
12	<i>Vismia sandwithii</i>	2	1,0	0,01	50	1,27	
13	<i>Trichilia solitudinis</i>	1	0,5	0,01	50	1,16	
14	<i>Terminalia dichotoma</i>	1	0,5	0,01	50	1,14	
15	<i>Ormosia macrocalyx</i>	1	0,5	0,01	50	1,14	
16	<i>Crudia glaberrima</i>	1	0,5	0,01	50	1,14	
17	<i>Macrolobium bifolium</i>	1	0,5	0,01	50	1,14	
18	<i>Aegiphila</i> sp.1	1	0,5	0,01	50	1,14	
19	<i>Indet11</i>	1	0,5	0,01	50	1,14	
20	<i>Spondias mombin</i>	1	0,5	0,01	50	1,14	

well represented (Figure S3). PERMANOVA showed no significant differences in species composition among flooding categories ($R^2 = 0.068$, $F = 1.62$, $p = 0.102$), suggesting that flooding explained only a small proportion of the variation.

5.1. Canonical correspondence analysis

Canonical Correspondence Analysis (CCA) was conducted using the 112 recorded species and 11 environmental variables selected after multicollinearity testing. The CCA explained 59.63% (3.0718) of the total inertia (5.1518), with the remaining 40.37% attributed to stochastic effects or unmeasured variables. The first two CCA axes together

accounted for 39.04% of the total variation, with axis 1 (CCA1) contributing 22.10% and axis 2 (CCA2) 16.94%. These results indicate that the CCA captured a moderate proportion of the variation in plant species distribution in relation to environmental factors, which is consistent with expectations for complex ecological datasets.

Permutation tests confirmed the significance of the overall analysis and individual axes ($p < 0.001$), validating the results. The CCA eigenvalues were 0.6787 for axis 1 and 0.5201 for axis 2, suggesting the existence of species turnover gradients across the sampled transects. Among environmental variables, only V ($p = 0.2603$) and clay ($p = 0.2503$) did not exhibit significant associations. Linear regression analysis identified 23 species with significant relationships to environmental gradients. A complete summary of CCA results is available in Supplementary Material S1 (C).

The spatial arrangement of sampling units along the two CCA axes (Figure 3) illustrates an environmental gradient influencing floristic composition and structure. The plots from T1 and T2 are positioned to the right of T3 plots, indicating floristic differentiation. The T3 plots formed a coherent cluster, strongly and positively associated with OM, while exhibiting negative associations with V, Al, and Mn. Additionally, *M. flexuosa*, *A. uleanus*, and *C. rubriflora* showed high abundance in T3, suggesting strong adaptation to this environment.

On axis 2, T1 and T2 plots displayed a more dispersed distribution along the gradient. T1 plots clustered in the upper left, with species such as *A. jauari*, *P. amazonum*, *H. spruceana*, *H. crepitans*, and *S. globulifera*, which showed positive correlations with Cu and Clay but negative correlations with pH. T2 plots, in the lower left sector, exhibited a stronger association with their predominant floristic composition, including *A. phalerata*, *C. guianensis*, *A. murumuru*, and *S. guianensis*. Negative correlations were observed between T2 plots and H+Al, P, and Flooding.

5.2. Ordination histograms

Patterns of species preference for specific soil attributes were evident in the analyses. Figure 4 illustrates that *M. flexuosa* and *C. rubriflora* were more abundant in soils with low aluminum and copper levels and a lower clay proportion. Conversely, *O. bacaba*, *Z. trunciflora*, *A. phalerata*, and *S. guianensis* were more common in areas with medium to high levels of these elements. Similar patterns emerged in relation to flooding duration, with *C. guianensis*, *G. poeppigiana*, *S. guianensis*, *O. bacaba*, and *Z. latifolia* preferring areas with fewer flooding days per year, while *M. flexuosa* was more abundant in areas experiencing prolonged inundation (Figure 4).

The effects of other soil parameters, such as H+Al, OM, and P, were also significant in determining species abundance (Figure S4). *M. flexuosa*, *C. rubriflora*, *A. oleanus*, *P. amazonum*, *V. surinamensis*, and *S. globulifera* were most abundant in plots with medium to high levels of these elements, while an inverse trend was observed for Mn (Figure S4 in the Electronic Appendix).

Figure S5 presents the results for base saturation (V) and pH, which exhibited minimal variation among plots. However, *M. flexuosa* and *C. rubriflora* showed a preference for higher pH and lower V values. Regarding Zn, these species were most abundant in intermediate fractions. Additionally, *F. maxima*, *O. splendens*, and *A. rigidum* were exclusively found in plots with low values of these same parameters (Figure S5 in the Electronic Appendix).

Hydro-edaphic effects on buriti forest

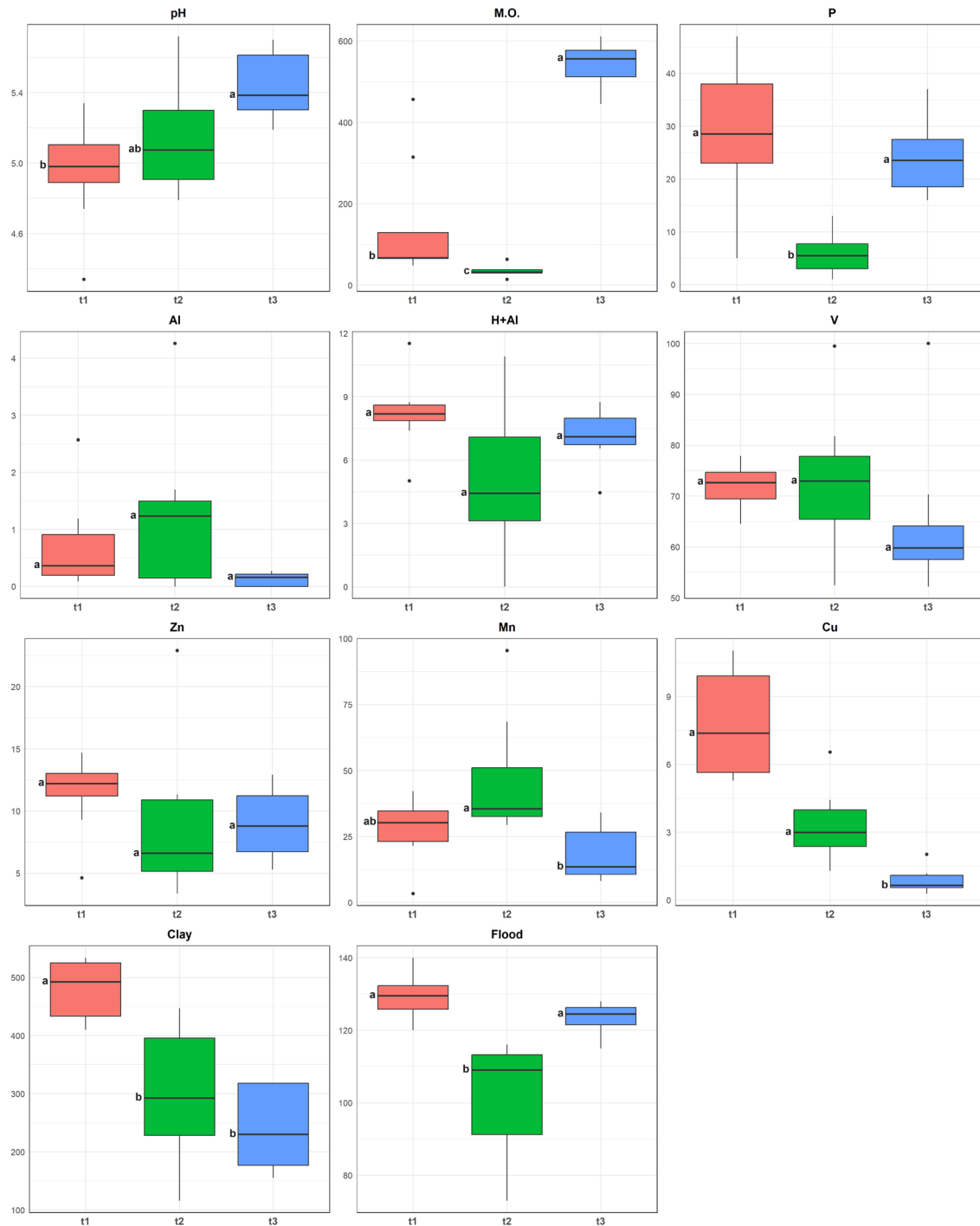


Figure 2. Boxplots comparing the environmental variables selected after testing for multicollinearity between the study areas: T1, T2 and T3. Each boxplot represents the distribution of data for a specific parameter in each environment, highlighting the differences observed between them with different letters. ARIE Javari-Buriti, Amazonas State, Brazil.

5.3. Abundance of *M. flexuosa*

The Classification and Regression Tree analysis (Figure 5) identified the most influential variables for *M. flexuosa* abundance. Organic Matter (OM) emerged as the primary factor, with 107 out of 135 sampled individuals occurring in areas where OM exceeded 495 g/kg ($C \times 1.724$). These individuals were concentrated in only

six of the 24 plots, reinforcing the phytosociological findings that indicated their dominance in T3. For individuals found in areas with OM below 495 g/kg, phosphorus (P) was the most significant explanatory variable. All 28 individuals in this group were recorded in plots where P exceeded 9 mg/dm³, distributed across 11 of the 18 plots within this range.

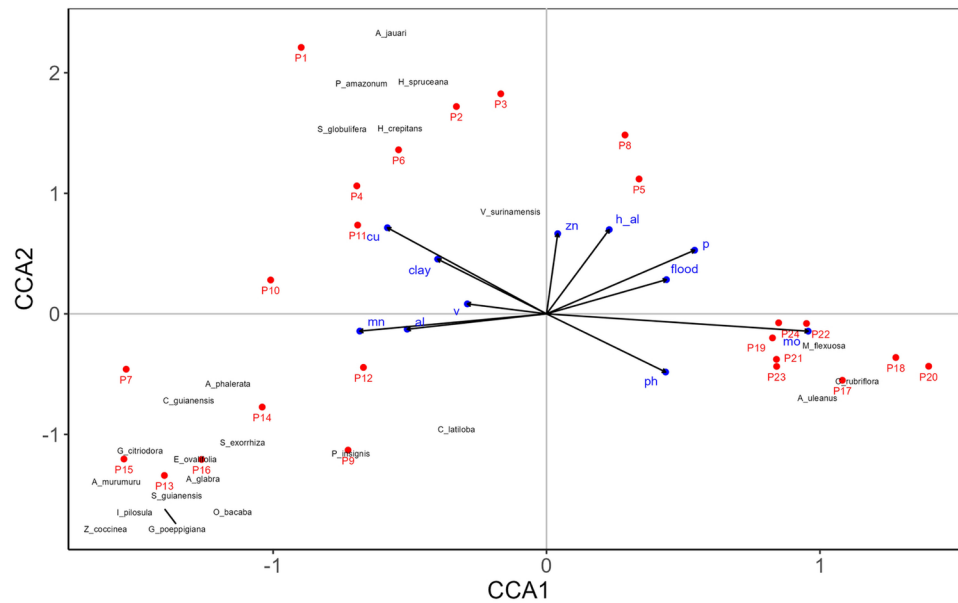


Figure 3. Canonical Correspondence Analysis (CCA): Ordination diagram of the plots (in red), based on the distribution of the species that demonstrated statistical significance and their relationship with the environmental variables employed (in blue). P1-P8 = T1; P9-P16 = T2; P17-P24 = T3. ARIE Javari-Buriti, Amazonas State, Brazil. Copper (cu), Manganese (mn), Base Saturation Index (v), Aluminium (al), Zinc (zn), Potential acidity (h_al), Phosphorus (p), Flood duration (flood) and Organic matter (mo).

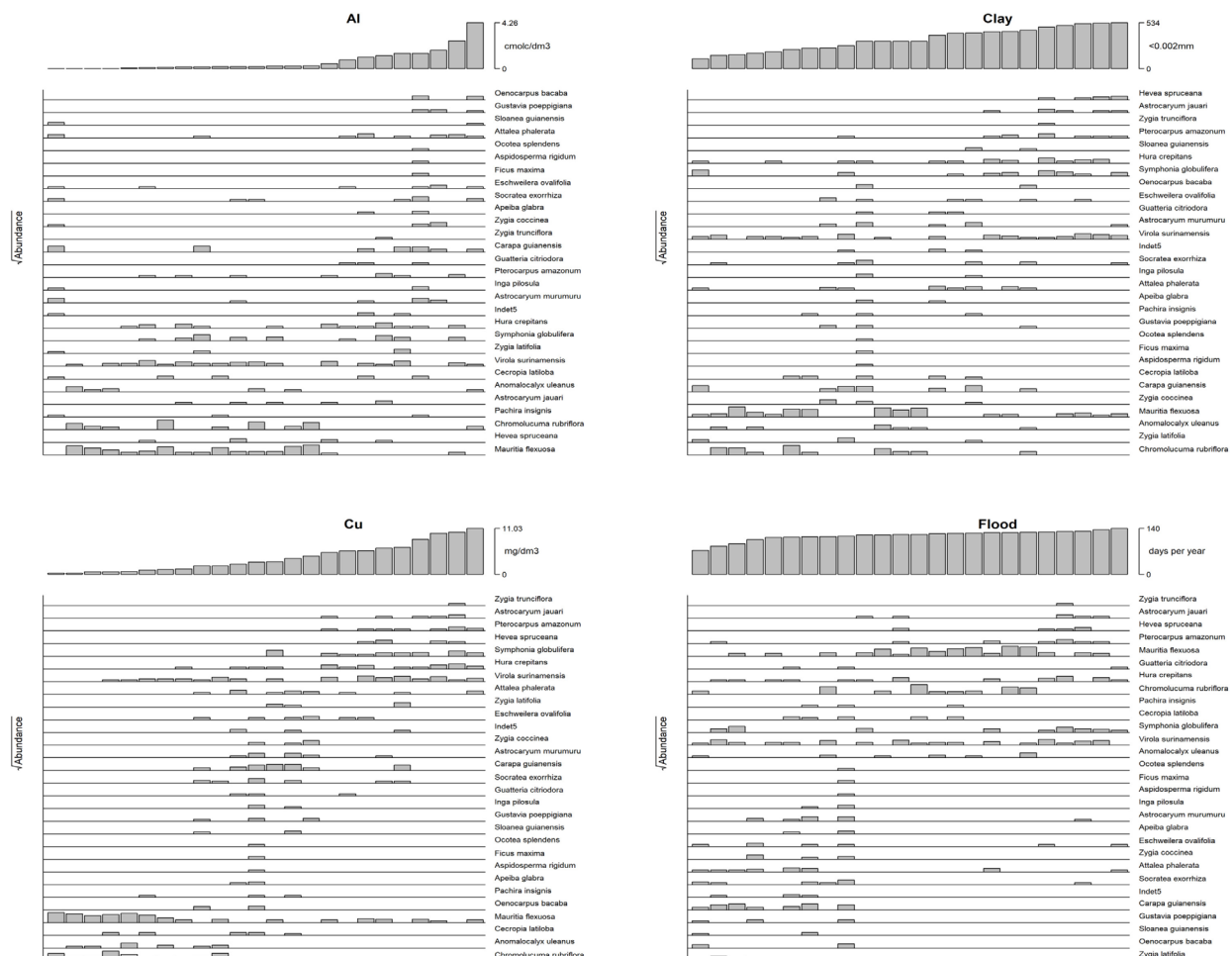


Figure 4. Ordination histograms for the environmental variables: Al, Clay, Cu and Flood. The species analysed were based on their significance in the CCA analysis. ARIE Javari-Buriti, Amazonas State, Brazil.

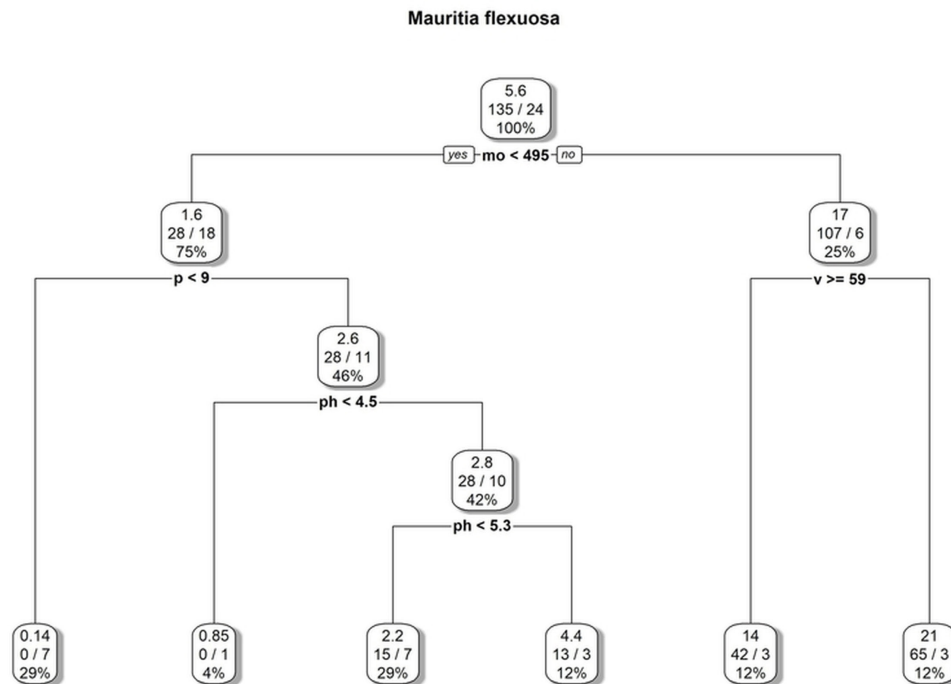


Figure 5. Classification and Regression Tree for the species *Mauritia flexuosa*. ARIE Javari-Buriti, Amazonas State, Brazil. Organic matter (mo), Phosphorus (p), Base Saturation Index (v).

Discussion

This study provides insights into the floristic composition, structure, and edaphic attributes of a *Mauritia flexuosa*-dominated forest in the Western Amazon, Brazil. While most research on *M. flexuosa* has focused on natural history, population ecology, and species interactions (Virapongse et al. 2017), our findings contribute to filling knowledge gaps on community and ecosystem-level processes, reinforcing the ecological importance of buritizais in Amazonian landscapes.

Comparisons with previous studies (Sander 2014; Sander et al. 2017; Oliveira et al. 2017, 2019) reveal both similarities and differences in floristic composition and phytosociological patterns. Consistent with Sander (2014), our results confirm *M. flexuosa*'s ecological dominance, alongside species such as *Virola surinamensis* and *Euterpe precatoria*. Floristic variations along environmental gradients were also evident, with transect 3 exhibiting lower species richness, aligning with Oliveira et al. (2017), who reported structural differences among savanna habitats. These variations may also stem from methodological differences, as our study employed transect-based inventories within a conservation unit, whereas Sander (2014) analyzed a buritizal in the Amazon-Cerrado transition, underscoring the importance of regional and methodological context in comparative studies of Amazonian wetlands.

The observed phytophysiognomic variation reflects the environmental complexity of the Amazon, where edaphic and hydrological gradients shape vegetation structure (Wittmann et al. 2006; Junk et al. 2011). Differences between transects indicate transitional zones between forest formations, with flooding and nutrient availability influencing species establishment. Transects with higher organic matter and prolonged flooding, such as T3, favor species adapted to waterlogged soils. Conversely, drier transects support greater floristic diversity,

resembling *várzea alta* forests and featuring species such as *P. jauari* and *P. amazonum* (Wittmann et al. 2010; 2002). These results align with Oliveira et al. (2017), who documented phytophysiognomic shifts along environmental gradients. In our study, transects T1 and T2 correspond to *várzea alta* conditions, characterized by shorter flooding duration and higher floristic diversity, whereas T3 represents a *buritizal* with longer inundation and monodominance of *Mauritia flexuosa*, as supported by the environmental and abundance data in Supplementary Material S2 (tabs Chem (A), Flood (C), and Abundance (D)).

A monodominance pattern emerged in the buritizal, with *M. flexuosa* prevailing in transect 3 (Anderson and Pires 1978; Emilio et al. 2013). Its high density and biomass suggest competitive exclusion of other tree species, particularly in environments with specific edaphic conditions and stronger water table influence, which may promote *M. flexuosa* regeneration (Wittmann et al. 2013). In contrast, transects with lower hydrological influence exhibited greater floristic diversity, emphasizing the role of environmental conditions in vegetation structuring.

The hydrological gradient also plays a fundamental role in defining floristic patterns in Amazonian wetlands. Although flooding did not significantly differentiate species composition in this study, clear tendencies were observed in the dominance of *Mauritia flexuosa* and *Chromolucuma rubriflora* in more inundated plots, and of *Carapa guianensis* and *Gustavia poeppigiana* in less flooded areas. Such patterns mirror those reported for *várzea alta* and *buritizal* forests, where subtle variations in flood duration and depth determine plant zonation and community assembly (Ferreira and Stohlgren 1999; Junk et al. 2011; Batista and Cunha 2012). Flooding thus acts synergistically with soil fertility to shape vegetation structure, favoring species adapted to low-oxygen soils and seasonal hydric stress.

Environmental factors are key to Amazonian forest structure (Quesada et al. 2012; Assis et al. 2014, 2018; Durgante et al. 2023). Soil properties, especially phosphorus and potassium, influence forest dynamics (Quesada et al. 2012), while dominant species' growth patterns, such as *Eschweilera coriacea*, respond to soil fertility and drought indices (Durgante et al. 2023). Hydroperiod also shapes floodplain forest composition (Assis et al. 2014, 2018), yet our results suggest a secondary role of flooding, as no significant correlation was found between species distribution and flood levels. This may be due to the relative topographic homogeneity of our study plots, minimizing flood duration variation.

Amazonian forests rely on nutrient cycling for ecosystem function (Vitousek 1984; Vitousek and Sanford 1986). Our results indicate a positive correlation between organic matter accumulation and species abundance in the buritizal, likely reflecting nutrient availability mediated by root exudates and microbial decomposition (Schaap et al. 2021), reinforcing the role of edaphic factors in wetland vegetation structuring.

This study builds on Galeano et al. (2015) and Rosa et al. (2014) regarding vegetation-environment interactions in *M. flexuosa* forests. Consistent with Galeano et al. (2015), our results highlight organic matter's influence on tree recruitment and mortality. Additionally, we corroborate Rosa et al. (2014), who linked seed mass and *M. flexuosa* productivity to soil organic matter and flooding. These findings enhance our understanding of buritizais, providing valuable insights for conservation planning and adaptive management in response to climate change and increasing anthropogenic pressures in the Amazon.

Conclusions

Our study identified two distinct phytophysiognomies in the ARIE Javari-Buriti: *várzea alta* (transect 1) and *buritizal* (transect 3), with a transitional zone in transect 2. This differentiation was supported by both floristic composition and structural attributes, as well as edaphic characteristics, reinforcing the ecological significance of this area. Among the environmental variables analyzed, soil properties—particularly organic matter and nutrient content—were the main drivers of floristic composition, while flooding acted as a secondary factor that modulated species distribution within each phytophysiognomy. The *buritizal* environment was strongly associated with high organic matter content and flood-tolerant species, whereas *várzea alta* areas exhibited greater diversity linked to better-drained soils. These findings contribute to a better understanding of habitat heterogeneity in the western Amazon and highlight the importance of integrating neglected environments into conservation strategies. Our results provide valuable data for the management of the ARIE Javari-Buriti and encourage further research in similarly understudied regions of the Amazon.

Supplementary Material

The following online material is available for this article:

Figure S1 – Schematic representation of the sampling layout in the ARIE Javari-Buriti. The figure illustrates the spatial arrangement of transects (T1–T3), conglomerates (C1–C2), and 25 × 25 m temporary plots (P1–P4), established along a hydro-edaphic gradient. Distances between plots and conglomerates are indicated to scale.

Figure S2 – Annual flooding intensity (days year⁻¹) for each plot derived from the Santo Antônio do Içá fluvioimetric station (Hidroweb code 11.500.000) and plot elevations. Lines denote transects (T1–T3), and x-axis labels encode Transect (T), Conglomerate (C), and Plot (P). Flooding ranged from 73 to 140 days year⁻¹, evidencing a hydrological gradient with lower values in T2 and higher values in T1 and T3. The underlying dataset is provided in Table S2 (tab “Flood”).

Figure S3 – NMDS ordination of species composition across flooding categories. Points represent sampling plots colored according to flooding categories (low, medium, and high), defined based on quantiles of the flooding gradient. Ellipses denote 95% confidence intervals for each flooding category.

Figure S4 – Ordination histograms for the environmental variables: H+Al, Mn, OM and P. The species analysed were based on their significance in the CCA analysis. ARIE Javari-Buriti, Amazonas State, Brazil.

Figure S5 – Ordination histograms for the environmental variables: pH, V and Zn. The species analysed were based on their significance in the CCA analysis. ARIE Javari-Buriti, Amazonas State, Brazil.

Supplementary Material S1 – Statistical analyses of environmental variables, canonical correspondence analysis (CCA), and representative tree species in the Javari-Buriti ARIE, Amazonas, Brazil.

Supplementary Material S2 – Chemical, physical, flooding, and tree abundance data from the Javari-Buriti ARIE, Amazonas, Brazil.

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Associate Editor

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Author Contributions

Karoline A. F. Ribeiro: study design; field data collection; data analysis; initial draft preparation; manuscript revision and approval.

Leonardo P. Reis: study design; leadership of field expeditions and data collection; manuscript revision and approval.

Pâmella L. S. Assis: study design; field data collection; data analysis; manuscript revision and approval.

Mário J. L. Castro: field data collection; botanical identification; manuscript revision and approval.

Paulo J. F. P. Nascimento: study design; field data collection; manuscript revision and approval.

Bruna M. Naissinger: data analysis; manuscript revision and approval.

Gabriela O. Souza: data analysis; manuscript revision and approval.

Darlene Gris: study design; data analysis leadership; manuscript revision and approval.

Conflicts of Interest

The author(s) declare(s) that they have no conflict of interest related to the publication of this manuscript.

Ethics

This study did not involve human beings and/or clinical trials that should be approved by one Institutional Committee.

Data Availability

The datasets generated and analyzed during the current study are available in different formats. The main dataset, including tree-level attributes, is available at the SciELO Data repository: <https://doi.org/10.48331/SCIELODATA.RIVAW4> (draft version). Additional data are provided as supplemental material in the journal's repository and via ForestPlots.net. Further details can be requested from the corresponding author.

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