Research, Society and Development, v. 11, n. 2, e8311225428, 2022
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v11i2.25428

Floristic composition in headwaters areas of the Piauitinga river Sub-Basin in Sergipe, Brazil

Composição florística em áreas de nascentes na Sub-Bacia Hidrográfica do Rio Piauitinga em Sergipe, Brasil

Composición florística en áreas de manantiales en la subcuenca del río Piauitinga en Sergipe, Brasil

Received: 01/06/2022 | Reviewed: 01/12/2022 | Accept: 01/17/2022 | Published: 01/18/2022

Crislaine Costa Calazans
ORCID: http://orcid.org/0000-0002-6100-0608
Universidade Federal de Sergipe, Brasil
E-mail: cris.calazans@yahoo.com.br
Gilmara da Silva Freire
ORCID: http://orcid.org/0000-0001-8374-6876
Universidade Federal de Sergipe, Brasil
E-mail: gilfreire21@hotmail.com
Ana Paula do Nascimento Prata
ORCID: http://orcid.org/0000-0001-7922-8355
Universidade Federal de Alagoas, Brasil
E-mail: apprata@yahoo.com.br
Robério Anastácio Ferreira
ORCID: http://orcid.org/0000-0003-4436-583X
Universidade Federal de Sergipe, Brasil
E-mail: roberioaf@yahoo.com.br

Abstract
Despite the riparian forest importance, it is evident that areas compose sub-basins undergo constant changes, culminating in these ecosystems' degradation. Thus, the floristic composition of nine headwaters of the Piauitinga River Sub-Basin, located in Sergipe, Brazil, will be presented. A collection of botanical material was taken within a radius of 50 m from the water edge of each source. The taxonomic identification of the specimens was developed considering specialized literature, taxonomic keys, expert consultation, comparison with dissected perianth and queries to the Virtual Herbarium. There were 190 species of vascular plants distributed in 146 genera and 55 families. 188 species of the Angiosperms group with 144 genera and 51 botanical families and the pteridophytes are represented by two species, belonging to two genera and two families. It is recommended the use of ecological restoration models that contemplate such species in future projects to be relayed in this planning unit.
Keywords: Degraded areas; Preservation; Species list.

Resumo
Apesar da importância das matas ciliares, constata-se que estas áreas que compõem as sub-bacias hidrográficas sofrem constantes alterações nos seus usos e funções, culminando em situações de grande degradação desses ecossistemas. Assim, será apresentada a composição florística de nove nascentes da Sub-Bacia Hidrográfica do Rio Piauitinga, situadas em Estância, Sergipe, Brasil. A coleta de material botânico foi realizada em um raio de 50 m a partir do olho d'água de cada nascente. A identificação taxonômica foi realizada mediante o uso de literatura especializada, chaves taxonômicas, consulta a especialistas, comparação com exsicatas e consultas ao Reflora - Herbário Virtual. Foram registradas 190 espécies de plantas vasculares distribuídas em 146 gêneros e 55 famílias, das quais 188 são angiospermas com 144 gêneros e 51 famílias botânicas e as Samambaias são representadas por duas espécies pertencentes a dois gêneros e duas famílias. Face a elevada diversidade encontrada nas nascentes estudadas no Rio Piauitinga, é possível recomendar o uso de modelos de restauração ecológica que contemplem tais espécies em futuros projetos a serem realizados nesta unidade de planejamento.
Palavras-chave: Áreas degradadas; Preservação; Lista de espécies.

Resumen
A pesar de la importancia de los bosques de ribera, parece que estas áreas que conforman las subcuencas hidrográficas sufren constantes cambios en sus usos y funciones, culminando en situaciones de gran degradación de estos ecosistemas. Así, se presentará la composición florística de nueve manantiales de la Subcuenca del Río Piauitinga, ubicada en Estância, Sergipe, Brasil. La recolección de material botánico se realizó en un radio de 50 m desde la

fuente de agua de cada manantial. La identificación taxonómica se realizó utilizando literatura especializada, claves taxonómicas, consulta con especialistas, comparación con exsiccates y consultas con Reflora - Herbario Virtual. Se registraron un total de 190 especies de plantas vasculares, distribuidas en 146 géneros y 55 familias, de las cuales 188 son angiospermas con 144 géneros y 51 familias botánicas, los helechos están representados por dos especies pertenecientes a dos géneros y dos familias. Dada la alta diversidad encontrada en las fuentes estudiadas en el río Piauitinga, es posible recomendar el uso de modelos de restauración ecológica que incluyan tales especies en los provectos futuros a realizarse en esta unidad de planificación.
Palabras clave: Áreas degradadas; Preservación; Lista de especies.

1. Introduction

The riparian forests correspond to the typologies of vegetation located on the banks of watercourses, headwaters and reservoirs. They play important roles, such as: protecting the banks of watercourses against erosion and silting and providing an adequate environment for local fauna, among others. Despite its importance, the rate of deforestation along riverbanks is accelerated (Silva, Cruz, Gonçalves, & Mesquita, 2016). The preservation of the gallery forests has great importance, since they increase the flow of rivers by storing more water in the micro-basins, besides contributing to the maintenance of their quality. Throughout Brazil, gallery forests vary widely, each region has a predominance of species that are adapted to local conditions (Oliveira, Guimarães, Souza, Lima, & Ferreira, 2015).

Water resources in general, and especially rivers and streams, are ecosystems that are altered by anthropic activities (Souza & Bulhões, 2015) and these forests are essential for the management and conservation of river basins.

In Brazil, the accelerated urbanization process evidences the need for watershed management and green areas recovery, which are crucial for groundwater recharge and maintenance of water quality and quantity (Tundisi et al., 2015).

However, it is deeply necessary to emphasize the importance of the preservation of headwaters which are points of the groundwater outcropping, giving rise to a water source, and, considering their relevance, targets of recovery projects in the Piauitinga Sub-Basin Hydrographic Region.

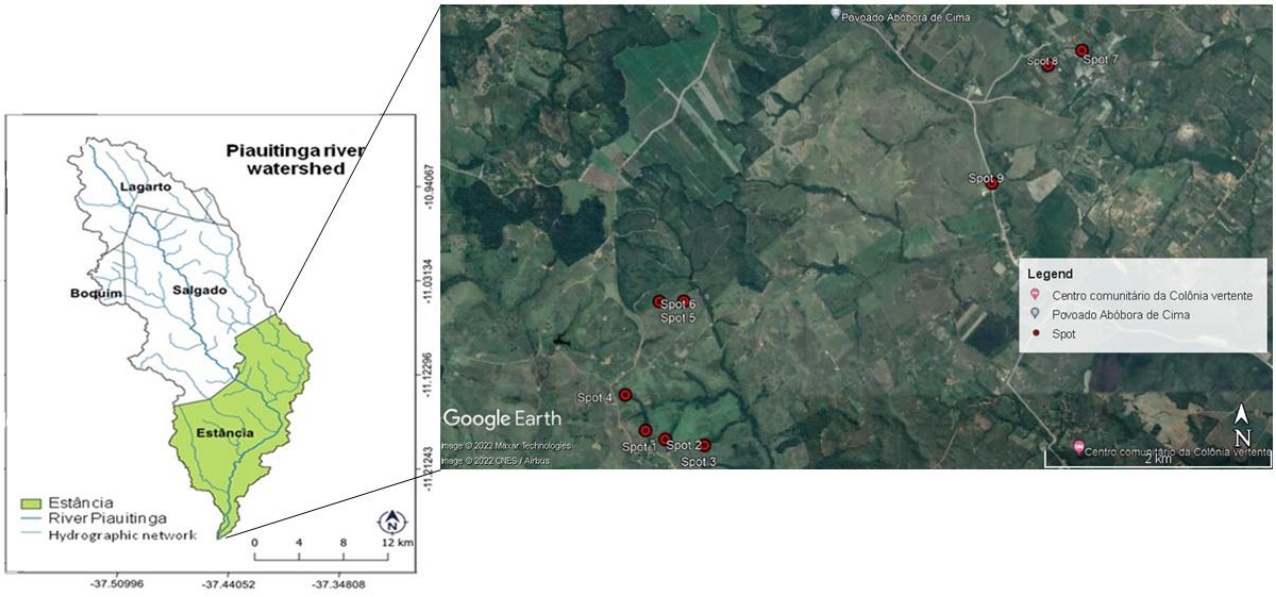
The presence of riparian forests along rivers, streams and dams serves as an obstacle to the free flow of runoff water, reducing its speed and allowing its infiltration into the soil for absorption by plants and for feeding underground aquifers (Silva et al., 2016).

This paper presents a list of species occurring in headwaters areas in the Piauitinga River Sub-Basin in the municipality of Estância and aimed to provide subsidies for riparian forest recovery programs in degradation in the region, considering the vegetative characteristics, the knowledge of the species and their ecological functions.

2. Methodology

The present study was carried out in nine sources of the Piauitinga River Sub-Basin, located in the municipality of Estancia, Sergipe, Brazil. The Piauitinga River rises in the municipality of Lagarto and flows into the Piauí River, in the municipality of Estancia, which is part of the Pauí River Basin. The Piauí River Basin is in the Center-South region of the State of Sergipe, between coordinates 10° 34'10 "and 10° 45'12" S and 37° 22'20 "and 37 ° 34'22" W, composing an area of 418.20 km2 (Figure 1) and its perimeter is 121.22 km (Moreira, 2008).

Figure 1. Location of sampling spots in spring areas of the Piauitinga River sub-basin and municipality of Estância, Sergipe, Brazil.



Source: Authors (2022).

The Piauitinga Sub-Basin is in the south-central part of the state of Sergipe, comprising the municipalities of Boquim, Estância, Lagarto, Salgado and Itaporanga D'Ájuda. The high course of the Piauitinga River receives contributions from tributaries with sufficient flow to be captured in Salgado, having great importance for water supply for human consumption, animal disintegration, irrigation, agriculture and livestock, element of industrial process, source of income for fishermen and its scenic beauty (Moreira, 2008).

The region vegetation was classified in the Submontane Semi-deciduous Seasonal Forest, transition between Estepic Savanna, Seasonal Forest and areas that suffered anthropization with cattle ranching and Arborized Estepic Savanna (Ministério do Meio Ambiente [MMA], 2021; Velloso, Rangel, & Lima, 1991).

The climatic type of the region is the sub-humid, with rains distributed year-round, concentrating from April to August, with only one to three dry months. The mean annual precipitation is 1,396.8 mm, with the highest average in the municipality of Estância (1,762 mm) and lowest in the municipality of Lagarto (1,064.8 mm) (Wanderley, 1998).

The soils of the region are: Red-Yellow Latosol, Red-Yellow Argisols and Flossic Neosol.

The floristic composition evaluations were carried out in nine headwaters, by means of collections of botanical material with reproductive structures, considering a radius of 50 m from the eye of each spring, determined with the aid of a set, totaling 7.85 m2. Considering the Permanent Preservation Area - APP the vegetation cover existing within a 50-m radius of the surroundings of a spring according to the Brazilian Forest Code (Law n. 12.651, 2012). The collection period lasted from October to December and from July to September, being carried out in dry and rainy periods of the region.

Samples of vascular plants (pteridophytes and phanerogams) were collected, belonging to different habits, such as: tree, shrub, grass and vine. At each headwater 3 to 5 samples, preferably fertile, were collected from each individual and the

data of the botanical material were recorded: flower and fruit color, habit, collectors and geographical coordinates of the area.

Identification. All collected material was pressed and taken to oven drying at 60 ° C for 48 to 72 hours. Later, they were duly deposited in the Herbarium of the Federal University of Sergipe (ASE) and the data were made available on Species link portal (Evironmental References and Information Center [CRIA], 2018). The taxonomic identification of the specimens was made by specialized literature, taxonomic keys, consultation with specialists, comparison with dissected perianth deposited in the general collection of the ASE Herbarium, queries to the Virtual Herbarium (REFLORA, 2018).

As for species classified, the Angiosperm Phylogeny Group VI classification system (The Angiosperm Phylogeny group [APG IV], 2016) was used and the spelling of the scientific names of the species and the determination of habit and origin of each species was performed according to the data available in Brazil Flora 2020 (The Brazil Flora [BFG], 2020). As for the habit, they were classified as herbaceous, shrub, arboreal and climbing. For the pteridophytes the list of species was presented in alphabetical order of botanical families, genera and species, including voucher, collector number and habit (Smith et al., 2006).

3. Results and Discussion

New records. A total of 190 species belonging to 53 families of vascular plants (Table 1) were found in the floristic surveys carried out in the plant formations of the Piauitinga River Sub-Basin, in the municipality of Estancia, Sergipe. Angiosperms contributed 188 species, 144 genera and 51 botanical families. The group of Pteridophytes was represented by two species belonging to two genera and two families. In terms of floristic richness, the Cyperaceae families with 26 species and Fabaceae with 24 species, followed by Asteraceae with 14 species and Poaceae with 12 species. These families accounted for 39.58% of total floristic wealth. The Malvaceae family obtained 10 taxa, followed by Rubiaceae with eight taxa, Melastomataceae with six taxa and Myrtaceae, Sapindaceae and Verbenaceae with five taxa each. 31 families were represented by only one specie.

Table 1. List of botanical families and species of Angiosperms and Pteridophytes from headwaters areas located at the Piauitinga River Sub-Basin, Estancia, Sergipe, Brazil, with their vouchers (ASE), collectors (name and number), and habits. Collector: Calazans, C.

FAMILY/ESPECIES	VOUCHER	COLLECTOR	HABITAT
AMARANTHACEAE			
Alternanthera tenella Colla	20913	C 402	Herbaceous
ANACARDIACEAE			
Anacardium occidentale L.	20987	C 433	Arboreal
Mangifera indica L.	20985	C.432	Arboreal
Tapirira guianensis Aubl.	20887	C 508	Arboreal
Thyrsodium spruceanum Benth.	20957	C 446	Arboreal
ANNONACEAE			
Duguetia sp.	20974	C 418	Arboreal
Xylopia frutescens Aubl.	20886	C 507	Arboreal
APOCYNACEAE			
Himatanthus bracteatus (A.DC.) Woodson	20897	C 501	Arboreal
Mandevilla scabra (Hoffmanns. ex Roem. & Schult.) K.Schum.	20936	C 379	Climber
Temnadenia odorifera (Vell.) J.F. Morales	20925	C 390	Climber
ASTERACEAE			
Ageratum conyzoides L.	21633	C 341	Herbaceous

Albertinia brasiliensis Spreng.	21637	C 307	Shrubby
Centratherum punctatum Cass.	20918	C 397	Herbaceous
Conocliniopsis prasiifolia (DC.) R.M. King & H. Rob.	21588	C 345	Herbaceous
Coreopsis lanceolata L.	20916	C 399	Herbaceous
Synedrellan odiflora (L.) Gaertn.	21593	C 371	Herbaceous
Emilia sonchifolia (L.) DC. ex Wight	20922	C 393	Herbaceous
Lepidaploa cotoneaster (Willd. ex Spreng.) H.Rob.	21590	C 346	Herbaceous
Mikania cordifolia (L.f.) Willd.	21594	C 370	Climber
Moquiniastrum oligocephalum (Gardner) G. Sancho	20966	C 455	Herbaceous
Pterocaulon virgatum (L.) DC.	19372	C 365	Herbaceous
Rolandra fruticosa (L.) Kuntze.	21617	C 368	Shrubby
Sphagneticola trilobata (L.) Pruski	20937	C 378	Herbaceous
Vernonanthura brasiliana (L.) H.Rob.	21587	C 324	Shrubby
BIGNONIACEAE			
Handroanthus sp.	20973	C 417	Arboreal
Lundia corymbifera (Vahl) Sandwith	21621	C 308	Climber
BORAGINACEAE			
Cordia sellowiana Cham.	20952	C 441	Arboreal
Heliotropium elongatum (Lehm.) I.M.Johnst.	20910	C 405	Herbaceous
CARYOPLYLLACEAE			
Spergula arvensis L.	20934	C 381	Herbaceous
CELASTRACEAE			
Maythenus sp.	20964	C 453	Arboreal
CHRYSOBALANACEAE			
Hirtella racemosa Lam.	20951	C 440	Arboreal
Licania tomentosa (Benth.) Fritsch	21601	C 327	Arboreal
CONVOLVULACEAE			
Ipomoea quamoclit L.	20924	C 391	Climber
Jacquemontia bracteosa Meisn.	20607	C 374	Climber
CUCURBITACEAE			
Momordica charantia L.	20915	C 400	Climber
CYPERACEAE			
Cyperus aggregatus (Willd.) Endl.	21948	C 21948	Herbaceous
Cyperus distans L.	21972	C 520	Herbaceous
Cyperus friburgensis Boeckeler	21940	C 21940	Herbaceous
Cyperus haspan L.	21956	C 21956	Herbaceous
Cyperus laxus Lam.	21963	C 21963	Herbaceous
Cyperus luzulae (L.) Retz.	21964	C 21964	Herbaceous
Cyperus odoratus L.	21957	C 21957	Herbaceous
Cyperus virens Michx.	21961	C 21961	Herbaceous
Cyperus sp. 1	21971	C 521	Herbaceous
Cyperus sp. 2	21943	C 21943	Herbaceous
Eleocharis geniculata (L.) Roem. &Schult.	21942	C 21942	Herbaceous
Fimbristylis autumnalis (L.) Roem. &Schult.	21950	C 21950	Herbaceous
Fimbristylis dichotoma (L.) Vahl	21937	C 21937	Herbaceous
Fuirena umbellate Rottb.	21941	C 21941	Herbaceous
Kyllinga brevifolia Rottb.	21965	C 21965	Herbaceous
Lipocarpha humboldtiana Nees	21960	C 21960	Herbaceous

Lipocarpha micrantha (Vahl) G.C.Tucker	21959	C 21959	Herbaceous
Pycreus polystachyos (Rottb.) P.Beauv.	21953	C 21953	Herbaceous
Rhynchospora barbata (Vahl) Kunth	21953	C 21953	Herbaceous
Rhynchospora cephalotes (L.) Vahl	21954	C 21954	Herbaceous
Rhynchospora holoschoenoides (Rich.) Herter	21962	C 21962	Herbaceous
Rhynchospora nervosa (Vahl) Boeckeler	21962	C 21962	Herbaceous
Rhynchospora tenuis Link	21952	C 21952	Herbaceous
Scleria bracteata Cav.	21955	C 21955	Herbaceous
Scleria hirtella Sw.	20942	C 519	Herbaceous
Scleria gaertneri Raddi	21939	C 21939	Herbaceous
DILLENIACEAE			
Curatella americana L.	20960	C 449	Arboreal
Tetracera oblongata DC.	21638	C 301	Shrubby
EUPHORBIACEAE			
Croton heliotropiifolius Kunth	20953	C 442	Shrubby
Croton sellowii Baill.	20958	C 447	Shrubby
Microstachys corniculata (Vahl) Griseb.	19370	C 337	Herbaceous
FABACEAE			
Andira fraxinifolia Benth.	20888	C 509	Arboreal
Bauhinia acuruana Moric.	20969	C 458	Shrubby
Bowdichia virgilioides Kunth	20892	C 506	Arboreal
Camptosema sp.	20935	C 380	Climber
Chamae cristanictitans (L.) Moench.	21632	C 338	Herbaceous
Clitoria fairchildiana R.A.Howard	20988	C 434	Arboreal
Desmodium barbatum (L.) Benth.	20929	C 386	Shrubby
Desmodium incanum (Sw.) DC.	20927	C 388	Herbaceous
Desmodium adscendens (Sw.) DC.	21597	C 367	Herbaceous
Dioclea lasiophylla Mart. ex Benth.	21595	C 355	Climber
Hymenaea rubriflora Ducke	20968	C 457	Arboreal
Inga cayennensis Sagot ex Benth.	20890	C 511	Arboreal
Inga vera Willd.	20983	C 429	Arboreal
Lonchocarpus sericeus (Poir.) Kunth ex DC.	20982	C 428	Arboreal
Mimosa pigra L.	21622	C 307	Shrubby
Mimosa pudica L.	20919	C 396	Shrubby
Mimosa tenuiflora (Willd.) Poir.	20967	C 456	Shrubby
Senna angulata (Vogel) H.S.Irwin & Barneby	19378	C 328	Shrubby
Stryphnodendron pulcherrimum (Willd.) Hochr.	20950	C 439	Arboreal
Stylosanthes guianensis (Aubl.) Sw.	21636	C 361	Herbaceous
Swartzia apetala Raddi	20975	C 419	Arboreal
Swartzia flaemingii Raddi	21599	C 314	Arboreal
Tachigali densiflora (Benth.) L.G.Silva & H.C.Lima	20971	C 420	Arboreal
Tephrosia cinerea (L.) Pers.	21624	C 300	Herbaceous
GENTIANACEAE			
Chelonanthus purpurascens (Aubl.) Struwe et al.	19373	C 357	Herbaceous
Coutoubeas picata Aubl.	19380	C 344	Herbaceous
HELICONIACEAE			
Heliconia velloziana L.Emygd.	20923	C 392	Herbaceous
HUMIRIACEAE			

Sacoglottis guianensis Benth.	21613	C 305	Shrubby
HYPERICACEAE			
Vismia guianensis (Aubl.) Choisy	20901	C 414	Arboreal
LAMIACEAE			
Aegiphila integrifolia (Jacq.) Moldenke	20899	C 416	Shrubby
Hyptis atrorubens Poit.	21618	C 323	Herbaceous
Hyptis sp.	20921	C 394	Herbaceous
Mesosphaerum pectinatum (L.) Kuntze	20920	C 395	Herbaceous
LECYTHIDACEAE			
Eschweilera ovata (Cambess.) Mart. ex Miers	20948	C 437	Arboreal
Lecythis pisonis Cambess.	20904	C 411	Arboreal
LOGANIACEAE			
Spigelia anthelmia L.	19374	C 350	Herbaceous
LYTHRACEAE			
Cuphea campestris Mart. ex Koehne	20917	C 398	Herbaceous
Cuphea racemosa (L.f.) Spreng	20939	C 335	Herbaceous
MALPIGHIACEAE			
Byrsonima sericea DC.	20955	C 444	Arboreal
Peixotoa parviflora A.Juss.	21627	C 351	Shrubby
MALVACEAE			
Eriotheca macrophylla (K.Schum.) A.Robyns	20893	C 505	Arboreal
Gossypium hirsutum L.	21592	C 356	Shrubby
Guazuma ulmifolia Lam.	20946	C 435	Arboreal
Luehea ochrophylla Mart.	19383	C 353	Shrubby
Pavonia cancellata (L.) Cav.	20905	C 410	Climber
Pavonia rosa-campestris A.St.-Hil.	20933	C 382	Shrubby
Sida sp.	21589	C 339	Herbaceous
Triumfetta semitriloba Jacq.	21630	C 336	Herbaceous
Urena lobata L.	19379	C 342	Herbaceous
Waltheria indica L.	20928	C 387	Herbaceous
MELASTOMATACEAE			
Clidemia capitellata (Bonpl.) D.Don	20909	C 409	Shrubby
Miconia amoena Triana	20902	C 413	Shrubby
Miconia ciliata (Rich.) DC.	20979	C 425	Shrubby
Miconia minutiflora (Bonpl.) DC.	20965	C 454	Shrubby
Pterolepis glomerata (Rottb.) Miq.	21635	C 360	Shrubby
Pterolepis trichotoma (Rottb.) Cogn.	21631	C 337	Shrubby
MORACEAE			
Sp.	21615	C 332	Arboreal
Sp.	21614	C 330	Arboreal
MUSACEAE			
Musa paradisiaca L.	20963	C 452	Shrubby
MYRTACEAE			
Campomanesia aromatica (Aubl.) Griseb.	20895	C 503	Arboreal
Eugenia punicifolia (Kunth) DC.	20972	C 421	Shrubby
Myrcia loranthifolia (DC.) G.P.Burton & E.Lucas	21623	C 306	Arboreal
Myrcia sylvatica (G.Mey.) DC.	21611	C 317	Arboreal
Myrciaria ferruginea O.Berg	21604	C 312	Shrubby

Psidium guajava L.	20896	C 502	Arboreal
Psidium guineense Sw.	20947	C 436	Arboreal
Syzygium cumini (L.) Skeels	20900	C 415	Arboreal
OCHNACEAE			
Ouratea cuspidata Tiegh.	20959	C 448	Shrubby
Sauvagesia erecta L.	21591	C 358	Herbaceous
ONAGRACEAE			
Ludwigia octovalvis (Jacq.) P.H.Raven	20914	C 401	Herbaceous
PASSIFLORACEAE			
Passiflora cincinnata Mast.	19375	C 348	Climber
PIPERACEAE			
Piper divaricatum G.Mey.	21598	C 369	Shrubby
POACEAE			
Andropogon bicornis L.	21969	C 21969	Herbaceous
Cenchrus echinatus L.	21966	C 21966	Herbaceous
Cenchrus polystachios (L.) Morrone	21968	C 21968	Herbaceous
Digitaria insularis (L.) Fedde	21945	C 21965	Herbaceous
Megathyrsus maximus (Jacq.) B.K.Simon & S.W.L.Jacobs	21967	C21967	Herbaceous
Panicum trichoides Sw.	21609	C 376	Herbaceous
Paspalum densum Poir.	21944	C21944	Herbaceous
Setaria parviflora (Poir.) Kerguélen	20885	C 515	Herbaceous
Steinchisma laxum (Sw.) Zuloaga	21947	C 21947	Herbaceous
Taquara micrantha (Kunth) I.L.C.Oliveira & R.P.Oliveira	21970	C 21970	Herbaceous
Urochloa decumbens (Stapf) R.D.Webster	20945	C 516	Herbaceous
Urochloa plantaginea (Link) R.D.Webster	20944	C 517	Herbaceous
POLYGALACEAE			
Polygala glochidata Kunth	20907	C 408	Herbaceous
POLYGONACEAE			
Coccoloba laevis Casar.	21600	C 315	Shrubby
Coccoloba rosea Meisn.	20970	C 459	Shrubby
RUBIACEAE			
Alseis pickelii Pilg. & Schmale	21612	C 312	Arboreal
Borreria capitata (Ruiz & Pav.) DC.	20906	C 409	Herbaceous
Borreria humifusa Mart.	21608	C 375	Herbaceous
Borreria verticillata (L.) G.Mey.	20912	C 403	Herbaceous
Eumachia chaenotricha (DC.) C.M. Taylor & Razafim.	20977	C 423	Shrubby
Genipa americana L.	20949	C 438	Arboreal
Guettarda blanchetiana Müll.Arg	20940	C 323	Arboreal
Tocoyena formosa (Cham. & Schltdl.) K.Schum.	20962	C 451	Shrubby
RUTACEAE			
Zanthoxylum rhoifolium Lam.	20978	C 424	Arboreal
Citrus ×aurantium L	20976	C 422	Shrubby
SALICACEAE			
Casearia sylvestris Sw.	20889	C 510	Shrubby
Casearia javitensis Kunth	21610	C 316	Shrubby
SAPINDACEAE			
Allophylus edulis (A.St.-Hil. et al.) Hieron. ex Niederl.	19377	C 331	Arboreal
Cupania impressinervia Acev. - Rodr.	20986	C 431	Arboreal

Matayba guianensis Aubl.	21605	C 319	Arboreal
Paullinia trigonia Vell.	21603	C 303	Climber
Serjania salzmanniana Schltdl.	21596	C 366	Climber
SAPOTACEAE			
Manilkara salzmannii (A.DC.) H.J.Lam	20989	C 460	Arboreal
Micropholis gardneriana (A.DC.) Pierre	21628	C 333	Arboreal
SIMAROUBACEAE			
Sp.	21634	C 318	
SOLANACEAE			
Cestrum axillare Vell.	20894	C 504	Arboreal
Solanum agrarium Sendtn.	20911	C 404	Shrubby
Solanum paniculatum L.	20954	C 443	Shrubby
Solanum stipulaceum Willd. Ex Roem. & Schult.	21619	C 322	Shrubby
TRIGONIACEAE			
Trigonia nivea Cambess.	21625	C 302	Climber
URTICACEAE			
Cecropia pachystachya Trécul	20961	C 450	Arboreal
VERBENACEAE			
Lantana camara L.	20908	C 407	Shrubby
Stachytarpheta angustifolia (Mill.) Vahl	19382	C 352	Herbaceous
Stachytarpheta cayennensis (Rich.) Vahl	20891	C 512	Herbaceous
Stachytarpheta sp.	20884	C 513	Herbaceous
Stachytarpheta sp.	28080	C 205 A	Herbaceous
VIOLACEAE			
Pombalia calceolaria (L.) Paula-Souza	21606	C 362	Herbaceous
VITACAE			
Cissus erosa Rich.	21620	C 310	Climber
VOCHYSIACEAE			
Vochysia lucida C.Presl	20898	C 500	Arboreal
XYRIDACEAE			
Xyris macrocephala Vahl	20943	C 518	Herbaceous
PTERIDOPHYTES			
LYGODIACEAE			
Lygodium venustum Sw.	19376	C 347	Herbaceous
THELYPTERIDACEAE			
Cyclosorusin terruptus (Willd.) H. Ito	21602	C 363	Herbaceous

Source: Authors (2022).

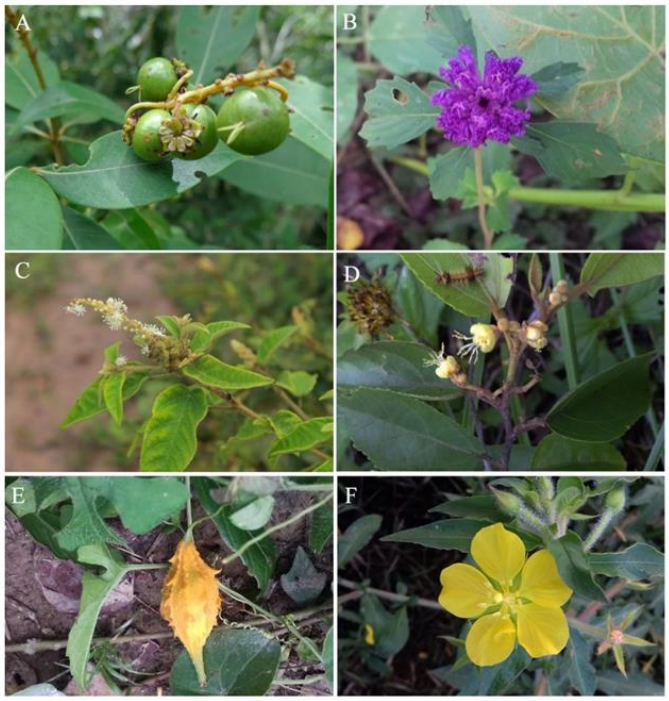
The most representative genera were: *Cyperus* (Cyperaceae) with 10 species, followed by *Rhynchospora* (Cyperaceae) with 5 species, *Stachytarpheta* (Verbenaceae) with 4 species and by *Borreria* (Rubiaceae) *Scleria* (Cyperaceae), *Solanum* (Solanaceae), *Desmodium*, *Mimosa* (Fabaceae) and *Miconia* (Melastomataceae) with 3 species each. 141 genera were represented by one or two species.

The species *Lygodium venuustum* Sw. (Lygodiaceae) and *Cyclosorus interruptus* (Willd.) H. Ito (Thelipteridaceae) are the only representative of the pteridophytes group.

Considering exclusively the shrub-tree flora of the 90 species, the richest families were Fabaceae (17 species) and Myrtaceae (eight species).

The families Cyperaceae and Poaceae were the most representative of the herbaceous strata, with 26 species and 12 species, respectively. This event may be related to the fact that the areas are clearly degraded. Individuals of these species are commonly found in areas with similar conservation conditions to the site studied. All the studied spots areas were classified as to previous land use as: extensive livestock farming or permanent crops (Calazans et al., 2020).

Figure 2. Botanic families most representative of the source areas of the Piauitinga River Sub-Basin, Estância, SE, Brazil. A. *Byrsonima sericea* Dc (Malpighiaceae); B. *Centratherum punctatum* Cass. (Asteraceae); C. *Croton heliotropiifolius* Kunth (Euphorbiaceae); D. *Guazuma ulmifolia* Lam (Malvaceae); E. *Momordica charantia* L. (Cucurbitaceae); F. *Ludwigia octovalvis* (Jacq.) P. H. Raven. (Onagraceae).



Source: Authors (2022).

The species *Byrsonima sericea* DC. (Malpighiaceae), *Cupaniaim pressinervia* Acev.-Rodr. (Sapindaceae), *Eschweilera ovata* Cambess Miers (Lecythidaceae), *Himatanthus bracteatus* (A.DC.) Woodson (Apocynaceae), *Cecropia pachystachya* Trécul (Urticaceae), *Cyperus luzulae* Hochst. Ex Steud. (Cyperaceae) and *Lantana camara* L. (Verbenaceae) stand out for the generalized occurrence, being specimens found in all areas of springs studied.

The most representative habit was the herbaceous (44.74% of the total), represented by 85 species distributed in 22 families, followed by arboreal (26.31%) with 50 species belonging to 21 families. Among the shrubs, 40 species were recorded in 18 families (21.05%), and the climbing plant habit was represented by 15 species (7.89%).

These results confirm studies of plant diversity of the Atlantic Forest covering the arboreal and non-arboreal strata, the herbs and lianas are responsible for about 50% of the total wealth found (Pessoa & Araujo, 2020).

The predominance of the herbaceous stratum was recorded in other floristic surveys in Atlantic Forest remnants (Almeida-Cortez, Tavares, Schulz, Pereira, & Cierjacks, 2016; Oliveira et al., 2016; Santana, Rocha, Silva, Ribeiro, & Prata,, 2017). It is worth noting that the herbaceous species have great importance to kick off the ecological processes of restoration areas, due to the rapid cover and modifications promoted in the soils, both at chemical and physical aspects, by the deposition

of organic matter and root growth, respectively.

Despite the advanced stage of degradation found in the study areas, the number of species recorded shows a high floristic diversity. Similar results were presented in floristic listings in Caatinga (Dry Forest) areas in Sergipe (Ferreira, Prata, & Mello, 2013; Silva, Prata, & Mello, 2013). The most representative families were Cyperaceae, Fabaceae, Asteraceae and Poaceae. The genera richest in number of species were: *Cyperus* and *Rhynchospora* belonging to the family Cyperaceae. For the tree species, there was a predominance of pioneer species. In this way, it is emphasized the importance of the understanding of species of different habits for the recovery and conservation of the environments, most notably the headwaters areas (Almeida-Cortez et al., 2016).

In a floristic composition study carried out in areas of springs in the same sub-basin in the municipality of Lagarto, 76 species from 58 genera were found, distributed in 36 botanical families (Ferreira et al., 2021).

The high number of individuals belonging to the Fabaceae family is also evidenced in work in which it reached a total of 24% of the study areas, this fact is associated with the strategies and adaptations of this family, due to the associations (Rhizobium and mycorrhiza), allowing the occurrence in the most diverse habitats.

Individuals of the Fabaceae family are widely used in projects to recover degraded areas since the species of this family can form a symbiosis with atmospheric nitrogen-fixing bacteria and mycorrhizal fungi. This technique can be considered low cost and with good results (Nogueira, Oliveira, Martins, & Bernardes, 2012).

The number of species recorded shows a considerable floristic diversity, despite the advanced stage of degradation found in the study areas.

4. Conclusion

The most representative families were: Cyperaceae, Fabaceae, Asteraceae and Poaceae and the richest genera in species were *Cyperus* and *Rhynchospora*, belonging to the Cyperaceae family.

The fact that the herbaceous component predominates over the other vegetation habits may be closely related to the use and exportation historic of the riparian areas around the headwaters, since the predominance of shrub-tree species, in the case of riparian forests. since the riparian areas around the headwaters are in a degradation stage.

With this work development, it was possible to know and update the number of species cited for the municipality of Estancia and the collection of the ASE Herbarium, besides providing subsidies for future work on headwaters restoration at the Piauitinga River Sub-Basin.

Acknowledgments

We thank all the members of the “Adote um Manancial” Project for their help and support in the field research. We also thank the ASE Herbarium for the collaboration on the identification of all collected material. To the financing agencies, Secretariat of Environment and Water Resources of Sergipe state (SEMARH), CNPq, CAPES. Partnership: State Public Ministry - Lagarto - SE (MP-SE), Society for Multiple, Ecological and Arts Studies (Semear), Federal University of Sergipe / Department of Forestry Sciences (DCF / UFS).

References

Almeida-Cortez, J. S. de, Tavares, F. M., Schulz, K., Pereira, R. de C. A., & Cierjacks, A. (2016). Floristic survey of the caatinga in areas with different grazing intensities, Pernambuco, Northeast Brazil. *Journal of Environmental Analysis and Progress*, *1*(1), 43–51. https://doi.org/10.24221/jeap.1.1.2016.986.43-51

Calazans, C. C., Ferreira, R. A., da Silva Freire, G., Pereira, G. S., Mann, R. S., Souza, J. L., Torres, M. F. O., & Nunes, V. V. (2020). Caracterização de

nascentes na sub–bacia hidrográfica do rio piauitinga, município de Estância, Sergipe (Characterization of springs in the sub-basin of the piauitinga river, municipality of Estância, Sergipe). *Global science and technology*, 13(1), 236-247. https://rv.ifgoiano.edu.br/periodicos/index.php/gst/article/view/1196

Centro de Referência em Informação Ambiental – (Evironmental References and Information Center). (2018). *Species link*. Retrieved August 18, 2020, from http://splink.cria.org.br/

Ferreira, E. V. R., Prata, A. P. D. N., & Mello, A. A. de. (2013). Floristic list from a Caatinga remnant in Poço Verde, Sergipe, Brazil. *Check List*, *9*(6), 1354. https://doi.org/10.15560/9.6.1354

Ferreira, R. A., Nascimento, M. I. C., Gama, D. C., Santos, T. I. S., Oliveira, D. G. de, Silva, A. J. da, & Mello, A. A. de. (2021). Aspectos da vegetação e estado de conservação de nascentes do rio Piauitinga, Sergipe-Brasil (Aspects of vegetation and conservation status of Piauitinga river's springs, Sergipe-Brasil). *Advances in Forestry Science*, *8*(4), 1591–1604. https://doi.org/10.34062/afs.v8i4.9699

Law nº 12.651, May 25, 2012. Institute a new Brazilian floristic code. Oficial Journal of the Federative Republic of Brazil. Executive Department, Brasília, Federal District.

Ministério do Meio Ambiente. (2021). *Mapas de cobertura vegetal dos biomas brasileiros (Maps of vegetation cover of the brazilian biomes)*. Federal Distict. Retrieved january 10, 2021, https://antigo.mma.gov.br/component/k2/item/7626-mapas-de-cobertura-vegetal.html

Moreira, F. D. (2008). *Geotecnologia aplicada à sub-bacia hidrográfica do Rio Piauitinga e suas relações ambientais. (Geospatial technology applied to the Piauitinga River hydrographic sub-basin and its environmental relationship)*. Dissertation, Federal University of Sergipe, São Cristovão, Sergipe, Brazil.

Nogueira, N. O., Oliveira, O. M. de, Martins, C. A. da S., & Bernardes, C. de O. (2012). Utilização de leguminosas para recuperação de áreas degradadas (Use of leguminosae for the recovery of degraded areas). *Enciclopédia Biosfera*, *8*(21), 1–7.

Oliveira, E. V. da S., Gomes, L. A., Déda, R. M., Melo, L. M. S., Silva, A. C. da C., Farias, M. C. V., & Prata, A. P. do N. (2016). Floristic survey of the Mata do Junco Wildlife Refuge, Capela, Sergipe State, Brazil. *Hoehnea*, *43*(4), 645–667. https://doi.org/10.1590/2236-8906-28/2016

Oliveira, L. C. S., Guimarães, J. C. O., Souza, I. C. S., Lima, C. M., & Ferreira, W. C. (2015). Levantamento florístico e fitossociológico da regeneração natural de uma mata de galeria localizada no município de Jataí – GO (Floristic and phytosociological survey of the natural regeneration of a gallery forest located in the municipality of Jataí - GO). *Global Science and Technology*, *8*(3), 59–77. https://doi.org/10.14688/1984-3801/gst.v8n3p59-77

Pessoa, S. de V. A., & Araujo, D. S. D. de. (2020). Tree species richness and composition in a fragmented landscape of the Brazilian lowland Atlantic Forest. *Rodriguésia*, *71*. https://doi.org/10.1590/2175-7860202071003

Reflora. (2018). *Virtual Herbarium*. http://reflora.jbrj.gov.br/reflora/herbarioVirtual

Santana, J. P., Rocha, P. A. da, Silva, T. R. da, Ribeiro, A. de S., & Prata, A. P. do N. (2017). Floristic characterization of Ibura national forest, Sergipe, Brazil. *Bioscience Journal*, 447–464. https://doi.org/10.14393/BJ-v33n2-33836

Silva, A. C. D. C., Prata, A. P. D. N., & Mello, A. A. de. (2013). Flowering plants of the Grota do Angico Natural Monument, Caatinga of Sergipe, Brazil. *Check List*, *9*(4), 733. https://doi.org/10.15560/9.4.733

Silva, G. A., Cruz, L. S., Gonçalves, F. D. S., & Mesquita, J. . (2016). Crescimento da aroeira-vermelha no reflorestamento da mata ciliar. (Aroeira-vermelha growthon reparian forestre forestation). *Agroforestalis News*, *1*(1), 8–12.

Smith, A. R., Pryer, K. M., Schuettpelz, E., Korall, E., Schneider, H. E., & Wolf, P. G. (2006). A classification for extant ferns. *Taxon*, *55*(3), 705–731.

Souza, V. G., & Bulhões, E. M. R. (2015). Environmental assessment through rapid assessment protocol low bed of the Paraíba do Sul River, In the Municipality of Campos Goytacazes / RJ. *Cadegeo*. http://www.cadegeo.uff.br/index.php/cadegeo/article/view/39

The Angiosperm Phylogeny group. (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. *Botanical Journal of the Linnean Society*, *181*(1), 1–20. https://doi.org/10.1111/boj.12385

The Brazil Flora. (2020). Brazilian Flora 2020: Innovation and collaboration to meet target 1 of the Global Strategy for Plant Conservation (GSPC). *Rodriguésia*, *69*(4), 1513–1527. https://doi.org/10.1590/2175-7860201869402

Tundisi, J. G., Tucci, C. E. M., Spilki, F. R., Hespanhol, I., Cirilo, J. A., Scheuenstuhland, M. C. B., & Periotto, N. A. (2015). Urban Waters in Brazil. In *urban water challenges in the Americas: A perspective from the Academies of Sciences.* (pp. 86–111). Rede Interamericana de Academias de Ciências (IANAS).

Velloso, H. P., Rangel, A. L. R., F., & Lima, J. C. A. (1991). *Classificação da vegetação brasileira adaptada a um sistema universal. (Brazilian vegetation classification adapted to a universal system)*.

Wanderley, L. L. (1998). *Litoral Sul de Sergipe: uma proposta de proteção ambiental e desenvolvimento sustentável. (An environment protection proposition and sustainable development)*. Dissertation. Universidade Estadual Paulista Júlio de Mesquita Filho Rio Claro, São Paulo, Brazil.