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Flora of Pernambuco, northeastern Brazil: new occurrences, overlooked species, conservation status assessments, and the conservation of *Cerrado* in the state

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Abstract: The state of Pernambuco harbors the second richest flora in northeastern Brazil and has been historically impacted by fragmentation of vegetation covering and habitat loss. Ongoing efforts on the flora of Pernambuco, based on fieldwork and analysis of herbarium collections, have revealed new occurrence records and neglected species. The fern *Anemia rosulata* is reported for the first time for Pernambuco whereas the angiosperms *Aspidosperma araracanga* and *Eriosema rigidum* are reported for the first time for northeastern Brazil. Additional twelve species have been overlooked by taxonomic monographs, including rare species in the state and species characteristic of *Cerrado*, which has been historically understudied in the state and neglected by governmental public policies. All fifteen species are threatened with extinction in Pernambuco based on IUCN criteria, including five species known from just one municipality each. We provide comments on morphology, ecology, and distribution for each species and discuss conservation of *Cerrado* in Pernambuco as well as importance of complete digitization of herbarium collections in the state. The results should assist in the preparation of a Red List of the flora of Pernambuco.

Key words: Ecotone, herbarium digitization, historical collections, peripheral plant populations, the botanist effect.

Flora de Pernambuco, nordeste do Brasil: novas ocorrências, espécies negligenciadas, avaliações do estado de conservação e a conservação do Cerrado no estado

Resumo: O estado de Pernambuco possui a segunda flora mais rica do Nordeste, que tem sido historicamente impactada pela fragmentação da cobertura vegetacional e perda de habitat. Esforços em andamento sobre a flora do estado, baseados em trabalho de campo e análise de coleções de herbário, revelaram novos registros de ocorrência e espécies negligenciadas. *Anemia rosulata* é referida pela primeira vez para Pernambuco, enquanto *Aspidosperma araracanga* e *Eriosema rigidum* são referidas pela primeira vez para o Nordeste. As demais doze espécies têm sido despercebidas por monografias taxonômicas e estudos florísticos recentes, incluindo espécies raras no estado e espécies características de Cerrado, que tem sido pouco estudado em Pernambuco e historicamente negligenciado por políticas públicas. Todas as quinze espécies estão ameaçadas de extinção no estado com base em critérios da IUCN, incluindo cinco espécies conhecidas de apenas um município cada. Neste trabalho fornecemos comentários sobre a morfologia, ecologia e distribuição de cada espécie e discutimos a conservação do Cerrado em Pernambuco, bem como a importância da digitalização completa das coleções de herbário no estado. Os resultados devem auxiliar na elaboração de uma lista vermelha da flora de Pernambuco.

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Palavras chave: Coleções históricas, digitalização de herbários, ecótono, efeito botânico, populações periféricas de plantas.

Introduction

The state of Pernambuco has the second richest flora of northeastern Brazil in number of plant species (Forzza *et al.* 2010; Flora e Funga do Brasil 2026). In contrast, the vegetation cover of Pernambuco has been drastically diminished by human activity (Kimmel *et al.* 2008; Trindade *et al.* 2008). The fragmentation and habitat loss in Pernambuco have been mainly associated with conversion into agricultural land, particularly sugarcane (Viana *et al.* 1997; Castelletti *et al.* 2003; Trindade *et al.* 2008). Based on data from the MapBiomas Project (2025), the extent with primary vegetation in Pernambuco has decreased about 40% between 1986 and 2023.

Such chronic anthropogenic pressures threaten the flora at different levels (Ribeiro *et al.* 2015, 2016, 2019) and their consequences are often measured through conservation status assessments at the species level and communicated through Red Lists, which may subsidize conservation strategies at local and regional scales. Nevertheless, the conservation status of less than 14% of about 46000 plant species occurring in Brazil has been assessed (CNCFlora 2025). In addition to the Brazilian Red List (Martinelli & Moraes 2013; Brasil 2022), state Red Lists have been published for Bahia (Bahia 2017), Espírito Santo (Simonelli & Fraga 2007), Minas Gerais (Mendonça & Lins 2000), Rio de Janeiro (Martinelli *et al.* 2018), and São Paulo (Mamede *et al.* 2007). A Red List of the Flora of Pernambuco, however, is still pending.

Meanwhile, many plant populations often remain unnoticed and hampers the achievement of accurate geographic distribution of taxa that represents one of the most readily available criteria for assessing extinction threat status (IUCN 2024). The rarity of species, a result of evolutionary history, habitat availability, and processes of habitat loss and fragmentation (Cody 1986), may aid in the elaboration of conservation strategies. In northeastern Brazil, most of the Atlantic Forest tree species have been known by up to five records and almost two hundred species were known from only one record (Tabarelli *et al.* 2006). Therefore, knowledge about the occurrence of plant populations can have a significant impact on the conservation of species that may be linked to the 'botanist effect' observed in tropical areas with high vascular plant diversity (Ahrends *et al.* 2011).

In Pernambuco, flora and vegetation have been assigned to Atlantic Forest and *Caatinga* phytogeographic domains (CONDEPE 2011; CPRH 2014; Flora e Funga do Brasil 2026), whereas the presence of *Cerrado* species and vegetation have been overlooked except for a few floristic studies (Santos *et al.* 2014; Athiê-Souza *et al.* 2019). *Cerrado* has been indicated as one of the four phytogeographic zones of Pernambuco, harboring species with restricted geographic distribution in the state (Andrade-Lima 1957) that are therefore important for conservation. However, *Cerrado* flora and vegetation in the state have been historically neglected by governmental publications, such as the Environmental Atlas of Pernambuco (CPRH 2014), as well as by public policies and financial agencies and consequently few resources have been directed towards its conservation.

As part of ongoing efforts on Flora of Pernambuco including analysis of herbarium specimens and fieldwork, we discovered the occurrence of vascular plant species in the state that have been overlooked by the literature, including species endemic to the *Cerrado*. The results include a new occurrence for Pernambuco and two new occurrences for northeastern Brazil. We present conservation status assessments for fifteen species in Pernambuco and provide comments on their identification, ecology, and distribution. Finally, we discuss the conservation of *Cerrado* flora and vegetation in the state and the importance of fully digitizing of herbaria collections for the conservation of the Flora of Pernambuco.

Material and Methods

Study area

Vegetation cover of Pernambuco is classified in five main zones/subzones [Andrade-Lima 1957; see Maciel & Costa-e-Silva (2011) for a map of the phytogeographic zones]: **i)** Littoral zone, which includes *restingas* and mangroves; **ii)** Forest zone, mostly corresponding to Atlantic Forest but also including submontane and montane forests reaching 1100 m in elevation within the *Caatinga* zone; **iii)** *Caatinga* zone, that corresponds to semiarid lands covered mostly by *Caatinga* vegetation and occupies most of the state territory; **iv)** *Agreste* subzone, a transitional region between the forest and the *sertão* zones that is subject to a hot, sub-humid climate with dry periods; and **v)** *Cerrado* zone, that includes two main disjunct sedimentary areas: one under the influence of the Araripe plateau in northwestern of the state and other near the coastline, regionally named *tabuleiros*, associated with the Barreiras Formation, a Miocene-aged geological substratum distributed along Brazilian coast.

The higher elevation areas present submontane (to 600 m in elevation) to montane (reaching 1100 m in elevation) evergreen to semideciduous forests that are regionally named *brejos de altitude.* These forests are characterized by tropical humid to sub-humid climates (reaching 1200 mm of annual rainfall) or subtropical, with temperatures as low as 10° C in the southern hemisphere winter (Santos & Tabarelli 2004).

Collection data, distribution maps, and conservation status assessments

We implemented searches of online herbarium collection databases of Reflora Virtual Herbarium (https://reflora.jbrj.gov.br/reflora/herbarioVirtual/; Reflora 2026) and speciesLink network (https://specieslink.net/; CRIA 2025) using the terms "*Cerrado*" or "*Campo Rupestre*" along with "Pernambuco" and checked their taxonomic identification. We also searched for specimens collected in municipalities with previous occurrence of *Cerrado* or *Campo Rupestre* based on literature (e.g., Santos *et al.* 2014). We also collected material during field excursions carried out in three municipalities in August and September 2023 and one municipality in March 2025 in the state of Pernambuco known by their high plant diversity and/or occurrence of *Cerrado* species. Voucher specimens were deposited at HUEFS (*Herbário da Universidade Estadual de Feira de Santana*), IPA (*Herbário da Empresa Pernambucana de Pesquisa Agropecuária*) and PEUFR (*Herbário da Universidade Federal Rural de Pernambuco*) herbaria and barcodes are provided when available. Sources of descriptions and field illustrations are provided for each taxon. Species are listed in alphabetical order according to family.

Two maps were elaborated using QGIS software version 3.28.11 (QGIS 2023) to depict the new records for the state and the occurrence of *Cerrado* species in relation to relief and climate. We opted for plotting species endemic to *Cerrado*, though we also discussed *Cerrado* species occurring in other vegetation types. For better visualization, we plotted only one record per species per municipality on the maps. Köppen-Geiger climate classification was based on Beck *et al.* (2023).

Phytogeographic domains delimitation was according to the IBGE (2023) biome delimitation. Geographic localization of known records was retrieved from the aforementioned databases. The location of historical records with missing original geographic coordinates was inferred from the analysis of satellite images of the region of occurrence, considering information contained in the exsiccate labels, such as proximity to villages and roads and travel routes of the collector, as well as characteristics of the species' habitat, such as altitudinal range and occurrence in flat areas or mountaintops.

We assessed conservation status in Pernambuco for each species using IUCN (2024) criteria and GEOCAT analysis (Bachman *et al.* 2011) to calculate AOO (area of occupancy) and EOO (extent of occurrence) using a default cell width of 2 km. The AOO was calculated for every species, while the EOO was calculated for species with three or more occurrence records in Pernambuco. We also used Google Earth (2026) to conduct visual inspections of available

satellite imagery from the last 50 years of each species' AOO to assess changes in vegetation cover as a measure of habitat quality.

Results and Discussion

Taxonomic treatment

1. *Anemia rosulata* Mickel (Anemiaceae), *Flora Neotropica* 118: 79, f. 43D–F. 2016.

Remarks: *Anemia rosulata* has been considered endemic to Bahia (Labiak 2026), where it is known from only three municipalities (CRIA 2025). The species was first described based on specimens growing in shade on dry banks at 460 m in elevation by the waterfall of the Rio Brumado, in the Chapada Diamantina, where several types of granites are found. We discovered a population of *Anemia rosulata* inhabiting a granitic rock outcrop in shade in a disturbed Atlantic Forest remnant at 670 m in elevation (**Figure 1**) in the municipality of Gravatá, Pernambuco. Our record is the first outside Bahia and is about 900 km away from the type-locality. The species was found growing associated with *Paepalanthus myocephalus* Mart. (Eriocaulaceae), *Peperomia blanda* (Jacq.) Kunth (Piperaceae) and several bryophyte species.

Identification: *Anemia rosulata* is morphologically similar to *Anemia dentata* Gardner, a species threatened with extinction (VU category; CNCFlora 2025), by the sterile fronds oblong and pinnate, the presence of only one fertile pinnae per frond, and the pinnae with venation and serrate margins, but differing mainly by the patent fronds forming rosettes (vs. erect fronds not forming rosettes; **Figure 2**).

Conservation assessment: *Anemia rosulata* is a rare species in Pernambuco known from only one locality outside legally protected areas. We categorized *A. rosulata* as CR B2ab(iii) in the state due to its AOO of 4 km^2 and inferred continuing decline in quality of habitat (IUCN 2024), mainly related to intense and disorderly tourist activities and urbanization.

BRAZIL – **Pernambuco** • Gravatá, 10.3 km from city, 08°17'32" S, 35°34'41" W, 670 m alt., 08.IX.2023, A.C. Mota & J.G. Carvalho-Sobrinho 1523 (UFP).

2. *Aspidosperma araracanga* Marc.-Ferr. (Apocynaceae), *Revista Brasileira de Botânica* 14: 127–129. 1991.

Remarks: *Aspidosperma araracanga* (**Figure 2**) has been considered to be an Amazonian species known in Brazil from all states of the northern region except for Amapá (Castello *et al.* 2026). We discovered an individual of *A. araracanga* inhabiting a wet forest fragment at 720 m in elevation in the municipality of Bonito, situated in the Atlantic Forest phytogeographic domain (**Figure 1**). Our record is the first of this species for Pernambuco and northeastern Brazil. The tree was found with leaves and fruits in September 2023. This occurrence represents an additional example of tree species geographically disjunct between the Atlantic and the Amazon forests, a pattern long documented (Andrade-Lima 1953, 1966; Bigarella *et al.* 1975; Prance 1979; Mori *et al.* 1981) and recently observed for 60 tree species in the state of Espírito Santo (Alves-Araújo *et al.* 2022).

Identification: *Aspidosperma araracanga* can be diagnosed based on the tree habit, with straight trunk, reaching about 40 m in height; the leaves are alternate and arranged along the branches (i.e., not grouped at the apices); the blades are glabrous, discolorous, and have craspedodromous venation, prominent main vein on abaxial surface and secondary veins evident on adaxial surface; the follicles are woody, suborbicular, c. 10 x 8 cm (reaching 18 cm long), stipitate, mucronate, externally brown, pubescent, with longitudinal ribs, with midrib prominent; the

seeds are 9 x 8 cm, orbicular, with seminal nucleus lateral, and lack radial lines (Pereira *et al.* 2016). Along its distribution, *A. araracanga* has been collected in flower from June to April (Pereira *et al.* 2016). Line drawings of *A. araracanga* can be found in Pereira *et al.* (2016, 2019).

Based on Pereira *et al.* (2016), *Aspidosperma araracanga* is morphologically similar to *A. desmanthum* Benth. ex Müll. Arg. and *A. melanocalyx* Müll. Arg. due to characters of follicles and seeds, but it can distinguished from the former based on the leaves with 39-41 pairs of secondary veins (vs. 21-26 pairs), the follicles suborbicular and brown (vs. dolabriform and yellow) and the seeds with lateral seminal nucleus (vs. central seminal nucleus); from the latter it differs by the glabrous abaxial surface of leaflets (vs. often velutinous), larger dimensions of follicles and seed wings as well as the seminal nucleus lacking radial lines (vs. with radial lines; e.g., CEN barcode 00049719, BHCB barcode 041836, UEC barcode 109414). Furthermore, according to Morales & Zamora (2017), *A. desmanthum* is restricted to the Amazonian basin.

Conservation assessment: *Aspidosperma araracanga* is a rare species in Pernambuco known from only one specimen collected in a fragmented vegetation outside legally protected areas. Additionally, montane forests in the municipality of Bonito are under very high anthropic pressure (Santos & Tabarelli 2004). We categorized *A. araracanga* as CR B2ab(iii) in the state due to its AOO of 4 km^2 and inferred continuing decline in quality of habitat (IUCN 2024), mainly related to grazing and selective logging in the AOO.

BRAZIL – **Pernambuco** • Bonito, 10,3 km from city, 08°29' S, 35°42' W, 720 m alt., 23.IX.2023, J.G. Carvalho-Sobrinho & A.C. Mota 4020 (HUEFS 285694).

3. *Handroanthus cristatus* (A.H. Gentry) S.O. Grose (Bignoniaceae), *Systematic Botany* 32: 664. 2007.

Remarks: *Handroanthus cristatus* has been referred only to the state of Espírito Santo, in southeastern Brazil, from where the holotype was collected (Lohmann 2026). However, the protologue includes a paratype from Pernambuco (Gentry 1992). In addition to the paratype, we discovered one herbarium specimen of *H. cristatus* collected in the municipality of Bezerros (**Figure 1**). Therefore, *H. cristatus* is a rare species in Pernambuco that has been overlooked in the state.

Identification: *Handroanthus cristatus* is morphologically similar to *H. umbellatus* by the leaflets puberulous, mostly on main veins; calyx irregularly caducous in fruit but differing by the calyx with conspicuously raised ridges below teeth and the exposed part of surface drying light (vs. calyx without ribs or with barely prominulous ribs and the exposed part of surface drying dark; swamp forest; Gentry 1992).

Conservation assessment: *Handroanthus cristatus* was categorized as Endangered (EN category) by Fernandez & Moraes (2019), but they included in their analysis a specimen (G. Fotius 3928) collected in Petrolina, in the semiarid region of Pernambuco. That specimen, however, was collected in the Atlantic Forest domain in the state of Sergipe, northeastern Brazil (HTSA 79, HUEFS barcode 000029788) therefore, the AOO and EOO calculation was misleading. This species was also considered Endangered by Brasil (2022). *Handroanthus cristatus* is known in Pernambuco from only two localities in disturbed vegetation outside legally protected areas and there is no recent evidence about the persistence of natural populations in the state. We categorized *H. cristatus* as Critically Endangered (CR category) as CR B2ab(iii) in Pernambuco based on the severely fragmented AOO of 8 km^2 and inferred continuing decline in quality of habitat (IUCN 2024).

BRAZIL – **Pernambuco** • Bezerros, subida para Serra Negra, 08°13'59.9" S, 35°47'48.8" W, 23.I.1997, A.M. Miranda 2569 (HST 6221) • Unknown municipality, entre Belo Jardim e Brejo da

Madre de Deus próximo à Serra dos Ventos, 02.XI.1956, D. Andrade-Lima 56-2614 (IPA 11036, MO barcodes 094766, 094767).

4. *Agarista revoluta* (Spreng.) Hook.f. ex Nied. (Ericaceae), *Botanische Jahrbücher* 11: 236. 1889.

Remarks: *Agarista* includes characteristically montane plants inhabiting open vegetation over acid soils and sprout readily after fire or disturbance (Judd 1995) and is most diverse in southeastern Brazil. *Agarista revoluta* is a Brazilian species known from *Cerrado* and *restinga* areas in the southeastern states of Espírito Santo, Minas Gerais, and Rio de Janeiro, and the northeastern states of Bahia and Sergipe (Romão *et al.* 2026). Based on searches of herbarium databases, we found specimens of *A. revoluta* collected in Pernambuco in coastal *restinga* as well as inland mountain areas about 1000 m in elevation in the municipality of Saloá, where *Cerrado* species have been collected. Despite the existence of herbarium records from the two localities, *A. revoluta* has been overlooked by Flora e Funga do Brasil (Romão *et al.* 2026). Based on fieldwork, we confirmed the presence of a population of *A. revoluta* in the "Serra da Prata" in the municipality of Saloá (**Figure 3**), that represents the northernmost occurrence of the species.

Identification: *Agarista revoluta* is a shrub to small tree species characterized by strongly revolute leaves, reticulate venation, and small ovoid capsules (**Figure 2**) and it comprises two varieties. In Pernambuco, only the nominate variety is found and can be distinguished from the variety *velutina*, known only from one coastal locality in the state of Bahia, by the leaves that are glabrous or pubescent only on the midrib abaxially (vs. abaxial surface entirely pubescent) and on the glabrous (vs. pubescent) corolla (Romão *et al.* 2026).

Conservation assessment: *Agarista revoluta* is a rare species in Pernambuco known from two localities outside legally protected areas. We categorized *A. revoluta* as EN B2ab(iii) in the state due to its AOO of 8 km^2, occurrence in only two localities, and inferred continuing decline in quality of habitat (IUCN 2024) mainly related to intense and disorderly tourist activities and urbanization in the coastal locality.

BRAZIL – **Pernambuco** • Recife, Piedade, 13.IX.1950, D. Andrade-Lima 50-644 (IAN 92954) • Saloá, Serra da Prata, 09°00'06" S, 36°47'06" W, 26.III.2025, A.C. Mota 1618 (UFP); 09°00'11" S, 36°47'06" W, 1065 m alt., 11.IX.2008, M. Oliveira 3565 (HVASF barcode 7962), 09°00'11" S, 36°47'06" W, 1065 m alt., 11.X.2008, M. Oliveira 3731 (HVASF barcode 7963).

5. *Calliandra blanchetii* Benth. (Fabaceae), *London Journal of Botany* 3: 102. 1844.

Remarks: *Calliandra blanchetii* is a shrubby species inhabiting *campo rupestre* vegetation between 650 and 1000 m in elevation in the *Caatinga* phytogeographic domain. It has been considered to be endemic to Bahia (Flora e Funga do Brasil 2026), where it is known from nine municipalities mostly in Chapada Diamantina mountain range. We found two herbarium specimens collected in two different localities of Pernambuco (**Figure 1**).

Identification: *Calliandra blanchetii* can be promptly distinguished from its congeners in Pernambuco by the combination of leaves with one pair of pinnae, the leaflets up to 7 mm long that are linear-oblong, and the pedicels 5 mm long (Renvoize 1981; Flora e Funga do Brasil 2026) often born on brachyblasts.

Conservation assessment: *Calliandra blanchetii* is a rare species in Pernambuco known from outside legally protected areas. We categorized *C. blanchetii* asCR B2ab(iii) in the state due to its AOO of 8 km^2 and inferred continuing decline in quality of habitat (IUCN 2024).

BRAZIL – **Pernambuco** • Floresta, 08.II.1949, A. Lima 49-180 (IPA 1083, IPA 1084) • Unknown municipality, Russinha, 04.II.1933, B. Pickel 3212 (IPA 3861).

6. *Calliandra umbellifera* Benth. (Fabaceae), *Journal of Botany* 2: 141. 1840.

Remarks: *Calliandra umbellifera* is a shrubby species inhabiting *Cerrado* vegetation and transitional vegetation to *Caatinga* (regionally named "*carrasco*") between 400 and 900 m in elevation in the *Cerrado* phytogeographic domain. It is known from the northeastern states of Ceará, Maranhão, and Piauí (Flora e Funga do Brasil 2026). We found herbarium specimens from five localities in the Araripe plateau sedimentary basin in western Pernambuco (**Figure 3**). The geographic distribution pattern of *C. umbellifera* fits that of the "northeastern group" that comprises one of the three supercentres of biodiversity of Brazilian *Cerrado* (Ratter *et al.* 2003).

Identification: *Calliandra umbellifera* is morphologically similar to *C. blanchetii* due to the pedicellate flowers in umbel and campanulate corollas; however, it can be distinguished based on the combination of viscous indument on branches (vs. viscous indument absent), persistent, larger stipules, leaves with (1–)2–3 pairs of pinnae, larger leaflets that are oblong, oblique, or obovate, rufous to yellowish on abaxial indument, and longer peduncles (Flora e Funga do Brasil 2026).

Conservation assessment: *Calliandra umbellifera* is a rare species in Pernambuco known from six localities outside legally protected areas. We categorized *C. umbellifera* as EN B2ab(iii) in the state due to its AOO of 24 km^2, occurrence in only six localities, and inferred continuing decline in quality of habitat (IUCN 2024).

BRAZIL – **Pernambuco** • Unknown municipality, campos da Serra do Araripe, margem estrada Araripina-Crato, 25.VI.1952, D. Andrade-Lima & M. Magalhães 52-1090 (IPA 5315, IAN barcode 99101) • Unknown municipality, Serra do Araripe, 03.I.1949, D. Andrade-Lima 49-157 (IPA 1057) • Araripina, entrada para Bodocó, estrada do Crato, 27.XII.1987, A. Fernandes s.n. (EAC barcode 0015176) • Exu, na estrada para Araripina, 06.VIII.1986, V.C. Lima 352 (IPA 49195); Serra de Exu, 04.XI.1986, V.C. Lima 431 (IPA 49245) • Ipubi, próximo de Serrolândia, 10.VI.1992, R. Pereira *et al.* 125 (IPA 54052) • Moreilândia, Chapada do Araripe, Serra da Mata Nova, 7°30'40" S, 39°28'53" W, 961 m alt., 21.XI.2015, J.F.O. Souza 12302 (HCDAL 12302, HUEFS barcode 261774).

7. *Eriosema rigidum* Benth. (Fabaceae), *Hortus Regius Botanicus Hafniensis* 22: 522. 1849.

Remarks: *Eriosema* is a tropical *Cerrado*-adapted genus (Cândido *et al.* 2020) especially diverse in the Central Brazil plateau (Cândido *et al.* 2019, 2026). *Eriosema rigidum* has been considered endemic to *Cerrado* vegetation in the states of Goiás, Minas Gerais and São Paulo (Cândido *et al.* 2019, 2026).

We found an herbarium specimen of *E. rigidum* (UFP 3949, J.L.H. Alves 135) collected in June 1971 and identified at genus level. The number UFP 3949 was assigned to two exsiccates: one comprising a specimen of *E. rigidum* and the other comprising a specimen of *Desmodium* sp. (Fabaceae); the *E. rigidum* exsiccate also contained one loose leaflet of the *Desmodium*. The original label of UFP 3949 indicates that the collection was made in "Serra Negra", a location name that refers to two distinct sites in Pernambuco with no *Cerrado* areas. We tracked the UFP numbering and discovered that UFP 3950 was assigned to the specimen J.L.H. Alves 102, collected in March 1971 (i.e., three months early) in the municipality of Itambé, which is known for the occurrence of *Cerrado* species (Andrade-Lima 1957), such as *Andira humilis* Mart. ex Benth. and *Harpalyce brasiliana* Benth. Therefore, we concluded that UFP 3949 includes a mixture of a *Desmodium* specimen collected in either of the "Serra Negra" locations and that *E. rigidum* was collected in *Cerrado* vegetation in the municipality of Itambé.

The record of *E. rigidum* in Pernambuco represents a disjunct occurrence of this *Cerrado* species and the first occurrence in northeastern Brazil. Such an occurrence represents an interesting phytogeographic finding and may be used to track the distribution of *Cerrado* in Pernambuco (see discussion below).

Identification: *Eriosema rigidum* is morphologically very distinct from its congeners by its whitish velutinous inflorescences that are shorter than the leaves, which are persistent during flowering (Cândido *et al.* 2019).

Conservation assessment: *Eriosema rigidum* is a rare species in Pernambuco known from only one collection from the year 1971 in the municipality of Itambé, northern Pernambuco (**Figure 3**). The vegetation cover of Itambé is currently very fragmented and we did not find individuals of *E. rigidum* during fieldwork in the municipality. Therefore, we categorized *E. rigidum* as CR B2ab(iii) in the state due to its AOO of 4 km^2, occurrence in only one locality, and inferred continuing decline in quality of habitat (IUCN 2024) mainly related to intense grazing in the Itambé region.

BRAZIL – **Pernambuco** • "Serra Negra", 21.VI.1971, J.L.H. Alves 135 (UFP 3949).

8. *Harpalyce brasiliana* Benth. (Fabaceae), *Journal of Botany* 3: 210, pl. 6. 1841.

Remarks: *Harpalyce* includes about 35 species of trees and shrubs with ecological predilection to seasonally dry tropical forests, *Cerrado*, and highland rupestrian grasslands (Arroyo 1976; Ross & Crisp 2005; São-Mateus *et al.* 2018). *Harpalyce brasiliana* is a shrubby species widespread in Brazilian *Cerrado* that occurs in the neighboring states of Bahia, Ceará, Paraíba, and Piauí (Cardoso *et al.* 2026). It has been recorded in Pernambuco only from two specimens collected in 1937 and 1950 in the municipality of Itambé and overlooked in Flora e Funga do Brasil (Cardoso *et al.* 2026). The unavailability of digital images of the specimens deposited at UFP in online databases and may have influenced the occurrence to be overlooked (see discussion below). *Harpalyce brasiliana* is a *Cerrado* endemic species that may be used to track the distribution of *Cerrado* in Pernambuco (see discussion below).

Identification: According to Cardoso *et al.* (2026), it can be recognized by the branches covered by tomentose or velutinous to sericeous indumentum that are ferruginous to yellowish, flowers larger than 2.8 cm long, and pods with 12–16 seeds.

Conservation assessment: *Harpalyce brasiliana* is known in Pernambuco only from the municipality of Itambé (**Figure 3**) and has not been collected for 75 years. There is no evidence of its occurrence inside legally protected areas or its persistence in the wild and we did not find individuals of *H. brasiliana* during fieldwork in Itambé, where the vegetation covering was found to be very fragmented. We categorized *H. brasiliana* as CR B2ab(iii) in the state due to its AOO of 4 km^2, occurrence in only one locality, and inferred continuing decline in quality of habitat (IUCN 2024), mainly related to intense grazing in the municipality.

BRAZIL – **Pernambuco** • Itambé, tabuleiro silicoso, IX.1937, Vasconcelos-Sobrinho 581 (IPA 581); Tabuleiro, 29.XII.1950, Andrade-Lima 50762 (HUEFS barcode 000242857, IPA 2005).

9. *Inga flagelliformis* (Vell.) Mart. (Fabaceae), *Flora* 20(2): Beibl. 112. 1837.

Remarks: *Inga flagelliformis* inhabits wet forests and presents a disjunct distribution between Amazonia (in the Brazilian states of Acre, Amazonas, and Pará) and the Atlantic Forest, as occurs for 60 other vascular species (Cavalcanti & Tabarelli 2004; Alves-Araújo *et al.* 2022). We found herbarium specimens of *I. flagelliformis* from six municipalities of the Atlantic Forest in

Pernambuco (**Figure 1**) that have been overlooked by recent floras, such as Flora e Funga do Brasil (2026).

Identification: *Inga flagelliformis* can be diagnosed based on the combination of persistent, ovate to falcate stipules, chartaceous leaflets, main vein salient on abaxial surface, acuminate to shortly cuspidate leaflets, terminal leaflets wide-elliptic to obovate, ramiflorous inflorescences, flowers in umbella at peduncle apices, long pedicels, and tubular calyces (Garcia & Bonadeu 2026).

Conservation assessment: *Inga flagelliformis* is known in Pernambuco from eight localities outside legally protected areas. Therefore, we categorized *I. flagelliformis* as EN B2ab(iii) in the state due to its AOO of 32 km^2 and inferred continuing decline in quality of habitat (IUCN 2024).

BRAZIL – **Pernambuco** • Escada, 22.XI.1967, J.T. Costa 145 (IPA 15015) • Ipojuca, RPPN Nossa Senhora do Outeiro de Maracaípe, 8°31'48" S, 35°01'05" W, 17.II.2005, E.B. Almeida Jr 598 (MAR 13116, 5692) • Igarassu, Usina São José, Engenho Campinas, 7°47'55" S, 35°1'12" W, 130 m alt., 17.I.2008, L.M. Nascimento 650 (ASE barcode 0023452, HVASF barcode 11875, INPA 230665, SPFR 13524); Usina São José, Mata da Piedade, 7°50'15" S, 35°00'10" W, 95 m alt., 19.XII.2007, D. Araújo 528 (HUEFS barcode 200009067, IPA 80229); Mata dos Macacos, 7°50'20" S, 35°00'10" W, 30 m alt., 21.XI.2002, I.M.M. Sá e Silva 14 (CEPEC 132331, JPB 34639, MO 3390017, NYBG barcode 01048756, PEUFR 41540) • Maraial, Faz. Céu Azul, 13.X.1957, A. Lima 2734 (IPA 11157); 01.I.1932, B. Pickel 2870 (IPA 2248) • Pombos, Uz. S. Pamphila, 01.I.1929, B. Pickel 1855 (IPA 2247) • São Vicente Férrer, Mata do Estado, 7°35' S, 35°30' W, 600 m alt., 23.VI.1998, E.M.N. Ferraz 535 (NYBG barcode 01048754, PEUFR 26216, VIC 24942); 21.I.1999, E.M.N. Ferraz 562 (HUEFS barcode 200008603, NYBG barcode 01048773, PEUFR 26374, VIC 24943); 13.I.2000, E.M.N. Ferraz 806 (HUEFS barcode 200008423, PEUFR 31192, VIC 024944) • Vicência, Serra do Jundiá, 29.XI.1957, A. Lima 2829 (IPA 11386).

10. *Inga tripa* F.C.P. Garcia & A.P. Chagas (Fabaceae), *Phytotaxa* 521(2): 95–104. 2021.

Remarks: *Inga tripa* was described based on material from Bahia, northeastern Brazil, where it has also been collected in the states of Alagoas, Ceará, Paraíba, Rio Grande do Norte, and Sergipe. It has also been collected in southeastern Brazil, in the state of Rio de Janeiro. For Pernambuco, we found two herbarium specimens of *I. tripa* but the occurrence of this species has been overlooked by recent floras such as Flora e Funga do Brasil (Garcia & Bonadeu 2026). The two specimens originated from semideciduous forests in the *zona da mata* and inland montane wet forests regionally named *brejos de altitude* at 645 m in elevation about 250 km from the coastline. A third specimen (EAN 16284) from Brejo de Madre de Deus was found identified as *I. tripa*, but without information on the collector, collector number or exsiccate images; therefore, we could not confirm the identification.

Identification: *Inga tripa* is morphologically similar to *I. alba*, a widespread species in Neotropics, due to the glabrous indument and shape of leaflets, but it can be distinguished by the cylindric, non-winged (vs. marginate to winged) leaf rachis, the relatively short, almost patent secondary veins (vs. with ascending, long secondary veins), and the strongly constricted fruits along its length (vs. not constricted or slightly constricted) between the seeds. It is also similar to *I. unica* Barneby & J.W. Grimes, a species endemic to southern Bahia and northern Espírito Santo, due to leaflets shape and long fruits, but it differs by the glabrous indument of branches, leaves, and fruits (Garcia & Bonadeu 2026). One material of *I. tripa* has been misidentified in herbaria as *Zygia latifolia* (L.) Fawc. & Rendle from which it can be promptly distinguished by the pinnate leaves (vs. bipinnate) and a very distinct leaflet secondary venation pattern.

Conservation assessment: *Inga tripa* is a rare species in Pernambuco known from two localities (**Figure 1**), one of which is inside the Tapacurá Ecological Reserve, a state-level legally protected area. We categorized *I. tripa* as CR B2ab(iii) in the state due to its AOO of 8 km^2, occurrence in only two localities, and inferred continuing decline in quality of habitat (IUCN 2024), exemplified by the presence of several invasive plant species in the Tapacurá Reserve (A.C. Mota, pers. obs.) and the severely fragmented AOO in Tacaratu (J. Carvalho-Sobrinho, pers. obs.).

BRAZIL – **Pernambuco** • São Lourenço da Mata, Estação Ecológica do Tapacurá, 8°00'46" S, 34°57'01" W, 09.I.2001, K. Almeida et al. 97, (NYBG barcode 01048751, PEUFR 37144, VIC 28492) • Tacaratu, Sítio dos Morcegos, 9°04'54" S, 38°08'02" W, 645 m alt., 14.I.2009, J.G. Carvalho-Sobrinho *et al.* 1835 (HUEFS barcode 200009962, HVASF barcode 11873).

11. *Leptolobium dasycarpum* Vogel. (Fabaceae), *Linnea* 11: 388. 1837.

Remarks: *Leptolobium* is a Neotropical genus comprising 12 woody species. *Leptolobium dasycarpum* is a tree species known from *Cerrado* and *campo rupestre* vegetation in Brazil in the regions north (Rondônia and Tocantins states), midwest (all states), southeast (Minas Gerais and São Paulo), and northeast (in the states of Bahia, Ceará, Maranhão, and Piauí; Rodrigues & Tozzi 2012; Rodrigues 2026). *Leptolobium dasycarpum* has been overlooked by a recent taxonomic revision of *Leptolobium* as well as Flora e Funga do Brasil (Rodrigues & Tozzi 2012; Rodrigues 2026) though cited for Pernambuco by Athiê-Souza *et al.* (2019). We found six herbarium specimens of *L. dasycarpum* collected in two municipalities in the central and northwestern regions of the state (**Figure 3**). *Leptolobium dasycarpum* is a *Cerrado* endemic species that may be used to track the distribution of *Cerrado* in the state (see discussion below).

Identification: *Leptolobium dasycarpum* can be distinguished from *L. parvifolium*, the other species occurring in the *Caatinga* phytogeographic domain, due to the rounded (vs. emarginate) petals and the pubescent to tomentose (vs. glabrous) ovary (Rodrigues & Tozzi 2012; Rodrigues 2026).

Conservation assessment: *Leptolobium dasycarpum* is known in Pernambuco from two municipalities: Buíque (including one record in the Catimbau National Park, a federal-level protected area) and Serrita, in the Araripe Plateau in the northwestern region of the state. We categorized *L. dasycarpum* as EN B1B2ab(iii) in the state due to its AOO of 20 km^2 and EOO of 4,596 km^2, occurrence in only five localities, and inferred continuing decline in quality of habitat (IUCN 2024) exemplified by the severely fragmented vegetation in the Araripe Plateau localities.

BRAZIL – **Pernambuco** • Buíque, Riachão, 08°33'19" S, 37°07'36" W, 863 m alt., 26.VI.2010, M. Oliveira 4991 & C.F. Fonseca (HVASF 8756 barcode 11481); Parque Nacional do Catimbau, 08°33'19" S, 37°06'58" W, 456 m alt., M. Oliveira 5417 (HVASF barcode 11910, HUEFS barcode 000238489); Estrada para Catimbau, 08.X.1971, D. Andrade-Lima 71-6559 (IPA 25882) • Serrita, Chapada do Araripe, próximo a Baixa Grande, na estrada Cariri Mirim-Crato, 24.I.1962, D. Andrade-Lima 62-4027 (CGMS 39048, IPA 12951, IPA 12952); Distrito de Jardimirim, Fazenda Brejinho, 07°35'30.7" S, 39°19'12.1" W, 914 m alt., 13.XII.2012, R.A. Silva 2427 (HVASF 18812); Serra do Gravatá, 07°32'55" S, 39°19'09" W, 848 m alt., 22.I.2012, A.C.P. Oliveira 2233 (HVASF barcode 11912, HUEFS barcode 000236092).

12. *Leptolobium parvifolium* (Harms) Sch.Rodr. & A.M.G. Azevedo (Fabaceae), *Taxon* 57: 983. 2008.

Remarks: *Leptolobium parvifolium* is a tree species known from *Cerrado* and *Caatinga* vegetation in northeastern Brazil in the states of Piauí and Ceará (Rodrigues & Tozzi 2012;

Rodrigues 2026). Its occurrence in Pernambuco has been overlooked by a recent taxonomic revision of *Leptolobium* as well as Flora e Funga do Brasil (Rodrigues & Tozzi 2012; Rodrigues 2026). We found only one herbarium specimen of *L. parvifolium* collected in the state of Pernambuco (**Figure 1**), whose original locality has been misinterpreted as Ceará state. However, the original exsiccate label heading at IPA herbarium (and RB) reads "Plantas da Caatinga Nordestina - Estado de Pernambuco" and the label at Kew specimen explicitly refers to the acronym "PE" for Pernambuco as the collecting locality, despite referring to a municipality of Ceará ("CE").

Identification: *Leptolobium parvifolium* can be distinguished from *L. dasycarpum*, the other species occurring in Pernambuco, based on characters discussed in *L. dasycarpum* above. In the field, it can be promptly distinguished due to the smaller leaflets with glabrous (vs. pubescent) indument on abaxial surface (Rodrigues & Tozzi 2012; Rodrigues 2026). Additionally, *L. parvifolium* inhabits *Caatinga* vegetation below 600 m in elevation, whereas *L. dasycarpum* inhabits *Cerrado* vegetation above 800 m in elevation.

Conservation assessment: *Leptolobium parvifolium* is a rare species in Pernambuco known from only one specimen collected in 1971 outside legally protected areas. We categorized *L. parvifolium* as CR B2ab(iii) in the state due to its AOO of 4 km^2, occurrence in only one locality, and inferred continuing decline in quality of habitat (IUCN 2024).

BRAZIL – **Pernambuco** • Unknown municipality, entre São José do Belmonte e Jati, 13.V.1971, E.P. Heringer *et al.* 752 (F 1866191, IPA 19638, K barcode 000188423, R barcode 10002850, RB barcode 00168242).

13. *Codonanthe mattos-silvae* Chautems (Gesneriaceae), *Revista Brasileira de Botânica* 14(1): 52. 1991.

Remarks: *Codonanthe mattos-silvae* has been reported in the neighboring states of Alagoas, Sergipe, and Bahia in northeastern Brazil where it inhabits wet forests (Chautems & Rossini 2026). In Pernambuco, *C. mattos-silvae* has been known from only one specimen collected in 2019 at 100 m in elevation about 17 km from the coastline in the phytogeographic region regionally named forest zone ("zona da mata"). The occurrence in Pernambuco was reported by Macedo *et al.* (2020), but the record has been overlooked by Flora e Funga do Brasil (Chautems & Rossini 2026). We have discovered an individual of *C. mattos-silvae* (**Figures 1–2**) at 700 m in elevation about 60 km from the coastline and 70 km southwest of the earlier record. The specimen was collected on the edge of an Atlantic wet forest remnant in the municipality of Gravatá. The two Pernambuco records represent the northern limit of the distribution of this species, which is rare in the state.

Identification: *Codonanthe mattos-silvae* can be recognized by the combination of epiphytic habit, anisophyllous leaves, heterosepalous calyces, and the presence of a calcar at the base of the corolla, which is obliquely oriented in relation to the receptacle (Chautems & Perret 2013).

Conservation assessment: *Codonanthe mattos-silvae* is known from only two localities in Pernambuco, one of which is inside a legally protected area (the APA Aldeia-Beberibe). We categorized *C. mattos-silvae* as CR B2ab(iii) in the state of Pernambuco due to its AOO of 8 km^2, and inferred continuing decline in quality of habitat (IUCN 2024) mainly related to grazing and selective logging in the AOO.

BRAZIL – **Pernambuco** • Gravatá, Estrada para Pedra da Lua, 6.5 km do centro de Gravatá, 08°15' S, 35°31' W, 700 m alt., 07.IX.2023, J.G. Carvalho-Sobrinho & A.C. Mota 4012 (HUEFS barcode

000100285686, IPA 77384) • Igarassu, Piedade, Usina São José (APA Aldeia-Beberibe), 07°50'12" S, 35°00'4" W, 100 m alt., 05.II.2019, A. Macedo 142 (UFP 87503).

14. *Sisyrinchium vaginatum* Spreng. (Iridaceae), *Systema Vegetabilium* 1: 166. 1825.

Remarks: The genus *Sisyrinchium* is widespread in Brazil and known from the northeast region (Eggers & Inácio 2026), but the occurrence of the genus in Pernambuco has been overlooked. *Sisyrinchium vaginatum* is typical of *Cerrado*, grasslands and high-altitude grasslands, and its occurrence in northeastern Brazil has been reported for the state of Bahia only (Eggers & Inácio 2026). We discovered three herbarium specimens of *S. vaginatum* collected in the municipality of Goiana, Pernambuco, which expands the northern limit of the species' geographic distribution.

Identification: *Sisyrinchium vaginatum* is a small herb with short stem leaves, flowers with six yellow tepals and partially united filaments (Eggers & Inácio 2026).

Conservation assessment: *Sisyrinchium vaginatum* is a rare species in Pernambuco known from two 70-year-old collections outside legally protected areas in the municipality of Goiana, in the northeast of the state. We categorized *S. vaginatum* as CR B2ab(iii) in Pernambuco due to its AOO of 8 km^2, the occurrence in two localities, and inferred continuing decline in quality of habitat (IUCN 2024) mainly related to sugar cane cultivation in the municipality.

BRAZIL – **Pernambuco** • Goiana, 28.I.1958, D. Andrade-Lima 58-2881 (IPA 11439), 23.III.1956, Usina Santa Teresa, D. Andrade-Lima 56-2549 (IPA 10975), Engenho Calungí, 08.V.1955, D. Andrade-Lima 2047 (IPA 7925).

15. *Esterhazya splendida* J.C.Mikan (Orobanchaceae), *Delectus Florae et Faunae Brasiliensis* 1: t. 5. 1820.

Remarks: *Esterhazya* J.C. Mikan is a small genus comprising five species inhabiting especially montane vegetation (Souza 2026) and its occurrence in Pernambuco has been overlooked. *Esterhazya splendida* is widespread in Brazil (Souza 2026) and has been recorded in only one municipality of Pernambuco since 1973. We collected *E. splendida* in *Cerrado* vegetation at 1050 m in elevation in the municipality of Saloá (**Figure 1**).

Identification: *Esterhazya splendida* can be recognized by the combination of leaves not appressed to the stem, calyx with short lobes, and red corollas (Souza 2026), as illustrated in **Figure 2**.

Conservation assessment: *Esterhazya splendida* is a rare species in Pernambuco known from only three localities outside legally protected areas in only two municipalities. We categorized *E. splendida* as EN B2ab(iii) in the state of Pernambuco due to its AOO of 12 km^2 and inferred continuing decline in quality of habitat (IUCN 2024), mainly related to tourist activities and installation of wind energy projects in the mountain areas of Saloá (A.C. Mota, pers. obs.).

BRAZIL – **Pernambuco** • Brejo da Madre de Deus, propriedade Bituri, 15.IX.1973, D. Andrade-Lima 73-7443 (IPA 29677); propriedade Bituri, 19.VIII.1980, A. Perruci 02 (IPA 25915); Serra do Ponto, 1050 m alt., 26.IV.2001, L.M. Nascimento 523 (SP 355168) • Saloá, Serra da Prata, 09°00'52" S, 36°47'02" W, 1050 m alt., 26.III.2025, A.C. Mota et al. 1612 (UFP).

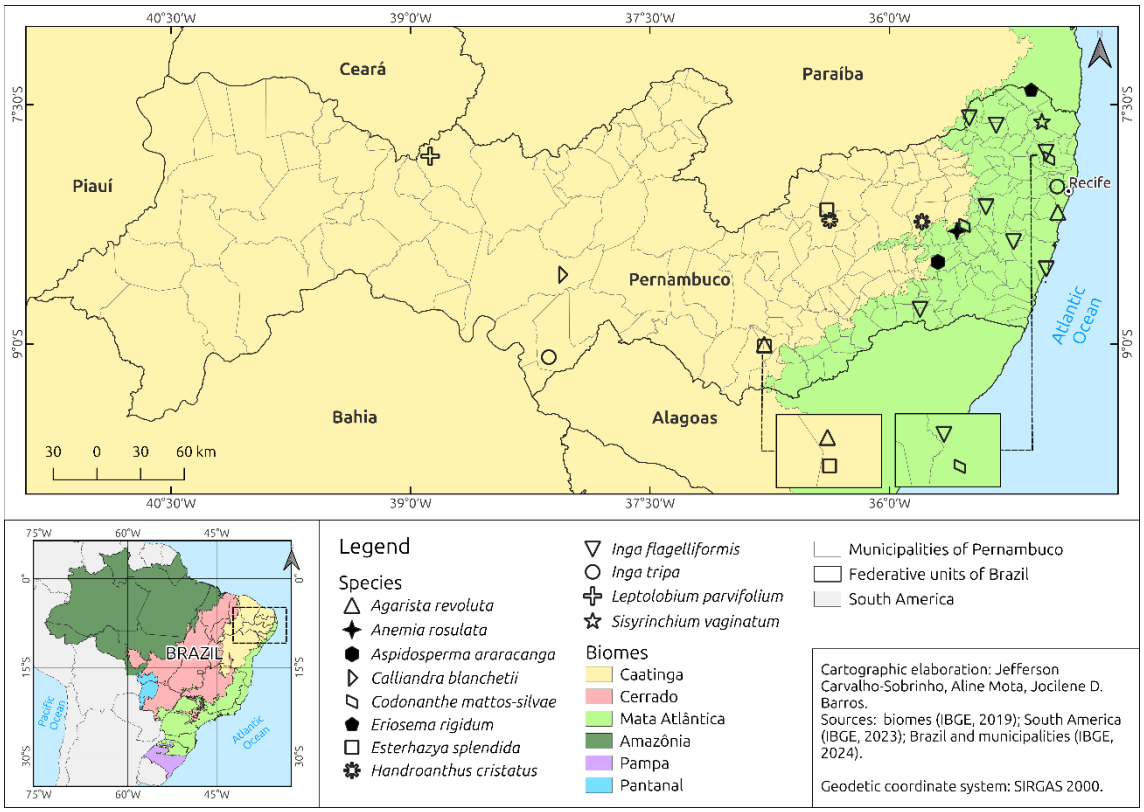

Figure 1. Distribution map of new occurrences (solid symbols) and overlooked species (empty symbols) in the Flora of Pernambuco, northeastern Brazil.

'The botanist effect' and the need for complete digitization of herbarium collections

The discovery of new records of vascular plant species in Pernambuco and the existence of species known from only one record in Pernambuco may be associated with multiple factors including chronic anthropogenic disturbances as well as the 'botanist effect', observed in tropical areas with high vascular plant diversity (Ahrends *et al.* 2011). 'The botanist effect' may be related in the state to unequal botanical sampling, historical local insufficiency of professional botanists, and lack of complete digitization of local herbarium collections.

Historically, sampling efforts in Pernambuco have been concentrated on a few localities and municipalities, especially on *brejos de altitude*, as evidenced in the literature (e.g., Porto *et al.* 2004; Santos & Tabarelli 2004). Based on speciesLink data (CRIA 2025), such a biased sampling has resulted in about 40% of all records for Pernambuco originating from 10 out of the total of 185 municipalities, with the five most sampled municipalities ranging from about 8000 to 20000 records each. In contrast, municipalities of occurrence of species discussed here have been relatively poorly sampled: the municipalities of Bezerros, Gravatá, and São Vicente Férrer were represented by less than 2000 records each, while Belo Jardim, Serrita, and Tacaratu were represented by less than 1000 records each. Such poorly sampled areas are often distant from larger cities with most traditional universities, a factor known to originate bias in sampling of biodiversity and research overall (Mota *et al.* 2024 and references therein).

Another factor possibly related to knowledge gaps is the historical scarcity of financial resources for floristic studies in the state that reflects the decline in resources for collections, biodiversity inventories and botanical training observed in other highly diverse tropical countries (Ahrends *et al.* 2011). Additionally, the lack of opportunities, especially permanent or long-term job positions, for taxonomists in northeastern Brazil may be related to these gaps. It is necessary to increase investments for herbaria, including to accomplish the full digitization of collections of Pernambuco, to provide botanists with access to good herbarium facilities, who often do not have sufficient funds to visit herbaria (Marhold *et al.* 2013).

Figure 2. New occurrences and overlooked, threatened species in the Flora of Pernambuco. *Anemia rosulata* (Anemiaceae), first reported for the state (**a**). *Aspidosperma araracanga* (Apocynaceae), previously known only from Amazonia (b-e). Leaves distributed along the branches, i.e., not grouped at the apices (**b**). Leaf shape variation (**c**). Venation on the abaxial surface (**d**). Follicle and seeds (**e**). *Agarista revoluta* (Ericaceae), an overlooked species with a northern distribution limit in Pernambuco (**f**). *Codonanthe mattos-silvae* (Gesneriaceae), a threatened and rare species in the state previously known from only one herbarium specimen (**g**). *Lafoensia glyptocarpa* (Lythraceae), a *Cerrado* endemic species (**h**). *Esterhazya splendida* (Orobanchaceae), a threatened species that is rare in Pernambuco, previously known from only one municipality (**i**).

The examination of herbarium collections is critical for biodiversity inventory and has been demonstrated to be as important as collecting new material in the field for species discovery (see, e.g., Ahrends *et al.* 2011). Among the overlooked species discussed here, four species (*Calliandra blanchetii*, *Eriosema rigidum*, *Harpalyce brasiliana, Leptolobium parvifolium*) were represented by historical collections. The specimens were deposited at Pernambuco herbaria that have not been completely digitized and are accessible through images of duplicates deposited at other herbaria.

Specifically, the peculiar case of *L. parvifolium* discussed illustrates how digitization of collections may improve herbaria database quality, especially regarding the Pernambuco collections. The only specimen collected in the state in 1971 was primarily deposited at IPA and duplicates were deposited at K and RB. While K and RB specimens were correctly determined *in loco* by a specialist in the years 1980 and 2010, respectively, the IPA specimen remained lacking such taxonomic determination, and was, in contrast, determined equivocally as *L. dasycarpum* in 2009 and remained so until we analyzed the specimen in 2024. The complete digitization of herbarium collections would have facilitated data exchange among the institutions and thus an updated determination of the specimen. Moreover, the RB specimen was also examined and correctly determined *in loco* by two other specialists in the years 1980 and 1988, exemplifying the different levels of data quality between a large, well-funded, and digitized herbarium and smaller, less-funded herbaria, and mostly non-digitized regional herbaria.

In addition to the digitization of Pernambuco herbaria collections, it is critical to provide local botanists with access to facilities such as JSTOR Plant Science (https://plants.jstor.org/). JSTOR Plants is the world's largest database of digitized plant specimens and includes taxonomic literature essential for biodiversity inventory but that is often inaccessible. The fact that no research institution in northeastern Brazil subscribes to JSTOR Plants hinders the researchers work and data quality necessary for conservation strategies in northeastern Brazil.

Ultimately, the quality of floristic data is critical to disclose reliable geographic distribution patterns and subsidize conservation strategies, and it is strongly related to 'the botanist effect'. The Flora e Funga do Brasil website has been largely used by environmental professionals, public agencies and decision makers. Consequently, it is critical that the vegetation type and geographic distribution are provided as accurately as possible for each taxon in the Flora e Funga do Brasil taxonomic monographs. However, not infrequently, *Cerrado* plant species are referred to as collected in *Caatinga sensu strictu* vegetation in taxonomic monographs based on information from exsiccate labels because specimens were collected in the *Caatinga* phytogeographic domain. Such vegetation referred as to *Caatinga* often represents ecotonal vegetation, not easily distinguishable by professionals not familiar with fine-scale variations of the flora and vegetation of northeastern Brazil.

As a consequence, several *Cerrado* endemic species collected in Pernambuco have been assigned to vegetation types such as, for example, *Caatinga sensu strictu* vegetation, and thus described as native to *Caatinga* on herbarium exsiccate labels such as, for instance, *Caryocar coriaceum* Wittm., with no reference to cultivated origin. Similar situations occur with, for instance, *Parkia platycephala*, a *Cerrado* endemic species (Hopkins 1986) often used as a characteristic *Cerrado* marker (Ratter *et al.* 2003) but eventually assigned to *Caatinga* and wet forest (e.g., Oliveira & Hopkins 2026). It is important to note that the option of assigning a species to ecotonal vegetation is not yet available in their system for in-charge specialists. Therefore, it is important that experienced botanists guide young taxonomists in charge of providing information on taxonomic monographs. The inclusion of comments on geographic and ecological aspects is encouraged, particularly when the origin of, often outliers, specimens is doubtful.

Pernambuco's neglected Cerrado

The term *Cerrado* defines a fire-adapted vegetation over relatively poor soils and characterized by trees with evergreen, sclerophyllous leaves. *Cerrado* occurs under tropical

climate with a pronounced dry season, with at least five to six months receiving less than 100 mm of rainfall. It is variable in physiognomy and floristic composition as shaped by regional and local constraints, such as proximity to neighboring domains (Eiten 1978; Ratter *et al.* 1997; Rizzini 1997; Fernandes 2000; Simon *et al.* 2009; Forzza *et al.* 2010; Simon & Pennington 2012).

The Brazilian *Cerrado* is a biodiversity hotspot encompassing 7066 species of vascular plants of which 1408 are endemic (Ratter *et al.* 1997; Myers *et al.* 2000; Flora e Funga do Brasil 2026). It is mainly associated with Brazil's Central plateau (Ab'Sáber 2003), but disjunct, peripheral *Cerrado* areas are known in north and eastern Brazil. *Cerrado* areas in northeastern Brazil are often found adjacent to regions with hot, semi-arid climate (i.e., BSh in Köppen's classification) and have been especially referred to the states of Bahia, Ceará, Maranhão, and Piauí, which are the larger states in the region (Machado *et al.* 2004; Klink & Machado 2005; IBGE 2019; Vieira *et al.* 2019; Gonçalves *et al.* 2024; Mendonça *et al.* 2024). Nevertheless, *Cerrado* areas have also been reported for Alagoas, Paraíba, Pernambuco, Rio Grande do Norte and Sergipe (Andrade-Lima 1957; Castro & Martins 1999; Machado *et al.* 2004; Oliveira *et al.* 2012; Diniz *et al.* 2022). Such peripheral areas in northeastern Brazil encompass a much richer flora than historically thought (Vieira *et al.* 2019).

Cerrado in Pernambuco has been largely overlooked by public policies and governmental publications (CPRH 2014) and not included in the priority areas for conservation of Brazilian biodiversity (Brasil 2007). According to IBGE (2019), *Cerrado* represents 14.5% of the vegetation covering of northeastern Brazil. Vegetation maps (CONDEPE 2011) indicate the existence of two *Cerrado* areas in Pernambuco that were first indicated by Andrade-Lima (1957): one associated with the Araripe plateau, and another associated with *tabuleiros* in the municipalities of Goiana and Itambé, nearer the coastline in the northeast of the state. The areas under the influence of the Araripe plateau are situated between 600 m and 900 m in elevation, whereas the Goiana and Itambé areas are below 200 m in elevation. The Goiana *Cerrado* was the only area of Pernambuco included in a meta-analysis of the flora of northeastern Brazilian *Cerrado* using literature data (see Vieira *et al.* 2019 and their Table S1). Strikingly, Maciel & Costa-e-Silva (2011) reported the lack of *Andropogon* L. (Poaceae) in *Cerrado* areas of Pernambuco, despite its high diversity in the South America *Cerrado*.

In Pernambuco, *Cerrado* areas are relatively small and occur from low altitudinal areas up to 1200 m in elevation associated with *brejos de altitude* or ecotone areas with predominance of *Caatinga* vegetation, such as the Catimbau Valley, in the transition of the *Agreste* subzone to *Caatinga* zone. Such *Cerrado* areas often do not display typical *Cerrado* physiognomy, and their flora is intermixed with that of the adjacent Atlantic Forest and *Caatinga* (Nepomuceno *et al.* 2021).

Idiosyncrasies of *Cerrado* areas in Pernambuco represented by their relatively small dimension and the eventual lack of a typical *Cerrado* physiognomy along with the persistence of historical anthropic factors such as conversion of land to agricultural use (Haynes 1970) and establishment of wind farm projects (Lima & Bezerra-Filho 2010; Maciel *et al.* 2024) may have played a role in the scarcity of herbarium records and literature about these areas. Furthermore, such issues can make it difficult to recognize and delimit these areas, especially using landscape approaches, demanding thorough examination of their floristics to correctly recognize them.

Most studies conducted on peripheral *Cerrado* areas have, however, focused on geographic and ecological rather than floristic aspects. An exception is the study of Santos *et al.* (2014), who attempted to demonstrate the occurrence of a *Cerrado* area in Pernambuco using the presence of particular species as predictors. However, they failed to present solid floristic evidence.

Among the species discussed here, *Eriosema rigidum* and *Harpalyce brasiliana* represent excellent examples of taxa endemic to *Cerrado* occurring in Pernambuco. These two genera occur in different *Cerrado* physiognomies especially on the Brazilian Central plateau (Arroyo 1976; Ross & Crisp 2005; São-Mateus *et al.* 2018; Cândido *et al.* 2020; Cândido *et al.* 2026). Taken together, the distribution of the *Cerrado* species in Pernambuco supports the occurrence of *Cerrado* in the areas indicated by Andrade-Lima (1957) and mapped by CONDEPE (2011). In

addition, our results indicate three additional areas of occurrence of *Cerrado* species: the Catimbau Valley, the Tacaratu mountain range, and the Serra da Prata in the municipality of Saloá. The former two areas are located over a sedimentary basement, whereas the latter is located over a crystalline basement (the Borborema plateau). All three of these areas along with the two *Cerrado* areas indicated in the literature are subject to a subhumid climate (see **Figure 3**). *Cerrado* areas in Pernambuco are relatively small and represent ecological enclaves within *Caatinga* and Atlantic Forest phytogeographic domains (**Figures 1** and **3**), as observed in other Brazilian northeastern states (e.g., Costa *et al.* 2004; Oliveira *et al.* 2012; Vieira *et al.* 2019; Nepomuceno *et al.* 2021; Diniz *et al.* 2022).

Furthermore, floristic data suggest the existence of two distinct *Cerrado* floras in Pernambuco based on the mutually exclusive distribution of the species. While the inland *Cerrado* areas (Chapada do Araripe, Catimbau Valley and Serra da Prata) share species such as *Leptolobium dasycarpum* and *Lafoensia glyptocarpa*, the *Cerrado* areas situated near the coast represent the unique area of occurrence of *Eriosema rigidum, Harpalyce brasiliana* and *Sysyrinchium vaginatum* in the state (**Figure 3**). Such floristic variation should be considered during conservation strategies of *Cerrado* taxa in the state (see discussion below).

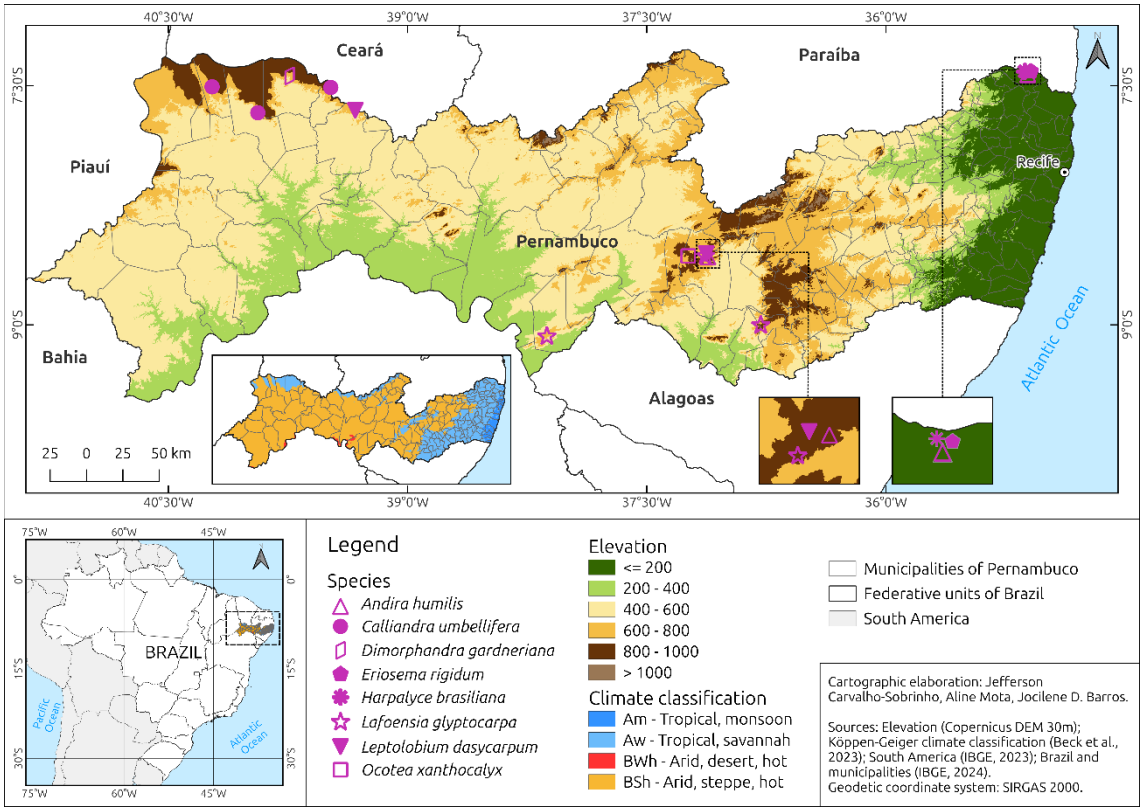

Figure 3. Distribution map of *Cerrado* species in high and low-elevation areas in the state of Pernambuco, northeastern Brazil. *Cerrado* areas are subject to Köppen's Aw climate type. Solid symbols indicate the first occurrence (*Eriosema rigidum*) or overlooked species.

In addition to the overlooked *Cerrado* species assessed above, a rapid search on speciesLink database (CRIA 2025) revealed the following *Cerrado* species in Pernambuco: *Annona coriacea* Mart. (Annonaceae); *Moquiniastrum oligocephalum* (Gardner) G. Sancho (Asteraceae); *Andira humilis*, *Bionia pedicellata* (Benth.) L.P.Queiroz, *Dimorphandra gardneriana* Tul., *Parkia platycephala* Benth. and *Vatairea macrocarpa* (Benth.) Ducke (Fabaceae); *Ocotea xanthocalyx* (Nees) Mez (Lauraceae); *Lafoensia glyptocarpa* Koehne (Lythraceae); *Byrsonima cydoniifolia* A.Juss. and *B. gardneriana* A. Juss. (Malpighiaceae); *Ouratea blanchetiana* (Planch.) Engl. (Ochnaceae); *Miconia caudigera* DC., *Miconia ferruginata* and *Mouriri pusa* Gardner (Melastomataceae). Among these, *A. humilis*, *B. pedicellata*, *M.*

ferruginata, *O. blanchetiana*, and *O. xanthocalyx* are endemic to *Cerrado* vegetation, of which the latter has its geographic distribution northern limit in Pernambuco.

Considering non-endemic taxa, about 1300 species of vascular plants found in Pernambuco inhabit *Cerrado* vegetation in Brazil, according to Flora e Funga do Brasil (2026). Therefore, evidence from both herbarium collections databases and literature clearly indicates the presence of *Cerrado* lineages in Pernambuco that should be investigated in more detail to be conserved through *in situ* and *ex situ* strategies.

Conservation of the Cerrado of Pernambuco

Accurate floristic approaches using records may aid in delimiting and mapping *Cerrado* taxa and areas for conservation in the state of Pernambuco. Floristic analysis should rely on thorough examination of herbarium specimens, especially historical collections, to subsidize grounded conservation strategies. *Cerrado* areas of Pernambuco contain peripheral, often disjunct plant populations that harbor unique evolutionary lineages with intrinsic value (e.g., they are more sensitive to environmental stresses if compared to the core population and are expected to diverge from central populations as a result of the interwoven effects of isolation, genetic drift, and natural selection) and thus must be studied with more detail and prioritized for conservation. They may contribute to shed light on *Cerrado* evolution through phylogeographic studies of widely distributed *Cerrado* species occurring in Pernambuco, that should be encouraged. Candidate species such as *Leptolobium dasycarpum* did not have populations from Pernambuco sampled (see Fava *et al.* 2020) probably because it was unknown despite the existence of a taxonomic revision of the genus (Rodrigues & Tozzi 2012), which reinforces the importance of accurate species distribution and of highlighting overlooked species and new records.

Analysis of the geographic distribution of *Cerrado* species should be encouraged. Current and potential geographic distribution should guide field efforts to detect the occurrence of *Cerrado* areas in Pernambuco that also should be investigated regarding the physical-chemical characteristics of soils. Priority candidate taxa include the endemic *Cerrado* species *Andira humilis*, *Bionia pedicellata*, *Eriosema rigidum*, *Harpalyce brasiliana*, *Leptolobium dasycarpum*, and *Ocotea xanthocalyx*. Species occurring in both *Cerrado* and *restinga*, a common geographic distribution pattern, may be useful, whereas widespread species occurring in various vegetation types should be avoided. Moreover, the use of knowingly cultivated species, such as *Hancornia speciosa* Gomes, *Caryocar* spp. and particularly *Anacardium occidentale*, is particularly challenging and requires additional caution and possibly fieldwork-based data refining. Importantly, *Cerrado* areas in Pernambuco often represent the only locality of occurrence of some species in the state, such as areas in Catimbau Valley (*Ocotea xanthocalyx*) and in the municipalities of Goiana (*Miconia ferruginata* and *Sisyrinchium vaginatum*), and Itambé (*Harpalyce brasiliana*).

As discussed above, *Cerrado* species in Pernambuco often inhabit ecotonal plant communities that in tropical areas have been revealed to present higher evolutionary (i.e., phylogenetic) diversity than in non-transitional communities (Rees *et al.* 2023). Therefore, ecotonal plant communities should not be underestimated based on their atypical physiognomy and demand conservation in parallel with detailed floristic and evolutionary studies.

Conservation strategies should include the creation of legally protected reserves of the "full protection" type (Brasil 2000) to warrant effective long-term conservation of the flora and vegetation of *Cerrado* in the state. The only federal-level legally protected areas including a representative number of *Cerrado* species in Pernambuco are the Catimbau National Park and the Private Natural Heritage Reserve "RPPN Fazenda Brejo" situated in the municipality of Saloá. However, selecting significant areas can be challenging, as most of them are highly anthropized and, therefore, species known only from historical collections may actually represent populations that are now extinct in the wild. Furthermore, the complexity of creating new legally protected reserves in Brazil and the historically persistent scarcity of resources for

conservation in the country, especially with regard to the full functioning of these areas, may hinder the achievement of conservation goals.

Therefore, an additional strategy may be to focus on conserving each species (e.g., Martins *et al.* 2014) through: **i)** searching and monitoring populations in the field to collect seeds for both *ex situ* (tissue culture and especially seed banking) and *in situ* conservation; **ii)** the establishment of plant nurseries involving municipal administration and local communities, who must be remunerated for activities related to seed-related activities (including collection, handling and storage), and habitat restoration. Such plant nurseries should be connected to the seed market to assist in increasing diversity and scaling restoration of the Brazilian *Cerrado* (see, e.g., Silva *et al.* 2022). Species characteristics, especially the number of individuals in the wild, and ethics during the collection of rare plant populations should guide actions in the field.

Conclusions

In loco detailed examination of herbarium collections in Pernambuco should be encouraged, especially historical collections that include unique records of the state's flora. This is especially important until the full digitization of local herbaria is completed. Financial and infrastructural limitations, together with the shortage of trained botanists, highlight the urgent need for institutional investment.

The compilation of a Red List of the Flora of Pernambuco based on thorough analyses of local herbarium collections is essential, as both historical and recent records reveal overlooked species threatened with extinction.

Floristic evidence confirms the presence of *Cerrado* in Pernambuco, including enclaves in the Araripe Plateau, the municipalities of Goiana and Itambé, the Catimbau Valley, Serra da Prata, and Serra de Tacaratu. However, this flora remains poorly known and increasingly threatened. Such *Cerrado* lineages occurring in ecotonal areas require experienced botanists for accurate field recognition. The occurrence of typical and often endemic *Cerrado* species highlights the importance of these areas as valuable remnants of natural heritage that should be incorporated into public policies and environmental planning.

Integrated actions are urgently needed, including: **i)** the complete and standardized digitization of local herbarium collections, particularly historical specimens; **ii)** the strengthening of taxonomic training and regional scientific infrastructure; and **iii)** the implementation of *in situ* and *ex situ* conservation strategies for both inland and coastal *Cerrado* floras. The establishment of legally protected "full protection" reserves, together with seed collection programs, community tree nurseries, and ecological restoration initiatives, are essential for conserving rare species and *Cerrado* lineages in Pernambuco.

Urgent conservation policies are necessary to prevent irreversible biodiversity loss and to support effective management and protection measures. A priority action should be the preparation of the Red List of the Flora of Pernambuco, including its *Cerrado* species.

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References

Ab'Sáber A.N. (2003) Os domínios de natureza do Brasil: potencialidades paisagísticas. São Paulo: Ateliê Editorial. 160 p.

Ahrends A., Rahbek C., Bulling M.T., Burgess N.D., Platts P.J., Lovett J.C., Kindemba V.W., Owen N., Sallu A.N., Marshall A.R., Mhoro B.E., Fanning E. & Marchant R. (2011) Conservation and the botanist effect. *Biological Conservation*, 144: 131–140. https://doi.org/10.1016/j.biocon.2010.08.008

Alves-Araújo A., Moreira M.M., Carrijo T.T., Lohmann L.G., Lobão A.Q., Scheidegger A.F., Firmino A.D., de Melo Silva A.V., Nepomuceno Á., Tuler A.C., Amorim A.M., Moreira A.L., Cosenza B.A., Sossai B.G., Silva C., Lopes C.R., Monteiro D., Couto D.R., Lima D.F., Dalcin E.C., Ramos E., Lírio E.J., Salimena F., de Oliveira F.A., Fraga F.R., Torres-Leite F., Antar G.M., Shimizu G.H., Lima H.C., Medeiros H., Luber J., Christ J.A., Lanna J., Zorzanelli J.P.F., Freitas J., Pastore J.F., Melo J.I., Paula-Souza J., Oliveira J.R., Pederneiras L.C., Freitas L., Giacomin L.L., Meireles L.D., Silva L.A., Pinto L.J., Menini Neto L., Trovó M., Garbin M.L., Morim M.P., Ribeiro M., Pena N.T., Labiak P.H., Cardoso P.H., Viana P.L., Moraes P.L., Moraes Q.S., Zorzanelli R.F., Amaral R.N., Asprino R.C., Goldenberg R., Magnago R., Couto R.S., Dutra S.C., Hoyos-Gómez S.E., Vieira T.A., Flores T.B., Dutra V.F., Miranda V.S., Manhães V.C. & Forzza R.C. (2022) Floristic survey of vascular plants of a poorly known area in the Brazilian Atlantic Forest (Flona do Rio Preto, Espírito Santo). *Biodiversity Data Journal*, 10: e75910. https://doi.org/10.3897/BDJ.10.e75910

Andrade-Lima D. (1953) Notas sobre a dispersão de algumas espécies vegetais no Brasil. *Anais da Sociedade de Biologia de Pernambuco*, 11: 25–49.

Andrade-Lima D. (1957) Estudos fitogeográficos de Pernambuco. Recife: IPA. 41 p.

Andrade-Lima D. (1966) Contribuição ao estudo do paralelismo da flora amazônica-nordestina. *Boletim Técnico do Instituto de Pesquisa Agronômica de Pernambuco*, 19: 1–30.

Arroyo M.T.K. (1976) The systematics of the legume genus *Harpalyce* (Leguminosae: Lotoideae). *Memoirs of the New York Botanical Garden*, 26: 1–80.

Athiê-Souza S.M. Melo J.I.M., Silva L.P., Santos L.L., Santos J.S., Oliveira L.S.D. & Sales M.F. (2019) Phanerogamic flora of the Catimbau National Park, Pernambuco, Brazil. *Biota Neotropica*, 19: e20180622. https://doi.org/10.1590/1676-0611-BN-2018-0622

Bachman S., Moat J., Hill A.W., De La Torre J. & Scott B. (2011) Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. *In*: Smith V. & Penev L. (Eds.). E-Infrastructures for data publishing in biodiversity science. *ZooKeys*, 150: 117–126. https://doi.org/10.3897/zookeys.150.2109

Bahia (2017) Portaria SEMA nº 40 de 21 de agosto de 2017, Lista Oficial das Espécies Endêmicas da Flora Ameaçadas de Extinção do Estado da Bahia. Diário Oficial do Estado da Bahia, ed. 22244: 22. https://dool.egba.ba.gov.br/ver-html/2787/#/e:2787 (accessed 22/February/2025).

Beck H.E., McVicar T.R., Vergopolan N., Berg A., Lutsko N.J., Dufour A., Zeng Z., Jiang X., van Dijk A.I.J.M. & Miralles D.G. (2023) High-resolution (1 km) Köppen-Geiger maps for 1901–2099 based on constrained CMIP6 projections. *Scientific Data*, 10: 724. https://doi.org/10.1038/s41597-023-02549-6

Bigarella J.J., Andrade-Lima D. & Riehs P.J. (1975) Considerações a respeito das mudanças paleoambientais na distribuição de algumas espécies vegetais e animais no Brasil. *Anais da Academia Brasileira de Ciências*, 47: 411–464.

Brasil (2000) Lei 9.985, de 18 de julho de 2000. Institui o Sistema Nacional de Unidades de Conservação da Natureza. https://www.planalto.gov.br/ccivil_03/leis/l9985.htm (accessed 14/March/2025).

Brasil (2007) Áreas prioritárias para conservação, uso sustentável e Repartição de Benefícios da Biodiversidade Brasileira: Atualização da Portaria MMA número 9, de 23 de janeiro de 2007. Brasília: Ministério do Meio Ambiente, Secretaria de Biodiversidade e Florestas.

Brasil (2022) Portaria MMA nº 148 de 07 de junho de 2022. Lista Nacional de Espécies Ameaçadas de Extinção. Diário Oficial da União 108: 74. https://in.gov.br/en/web/dou/-/portaria-mma-n-148-de-7-de-junho-de-2022-406272733 (accessed 13/May/2025).

Cândido E.S., Vargas W., Bezerra L.M.P.A., Mansano V.F., Vatanparast M., Lewis G.P., Tozzi A.M.G.A. & Fortuna-Perez A.P. (2019) Taxonomic synopsis of *Eriosema* (Leguminosae: Papilionoideae, Phaseoleae) in Brazil. *Phytotaxa*, 416(2): 91–137. https://doi.org/10.11646/phytotaxa.416.2.1

Cândido E.S., Vatanparast M., Vargas W., Bezerra L.M.P.A., Lewis G.P., Mansano V.F., Simões A.O., Silva M.J., Stirton C., Tozzi A.M.G.A. & Fortuna-Perez A.P. (2020) Molecular phylogenetic insights into the evolution of *Eriosema* (Fabaceae): a recent tropical savanna-adapted genus, *Botanical Journal of the Linnean Society*, 194: 439–459. https://doi.org/10.1093/botlinnean/boaa059

Cândido E.S., Perez A.P.F. & Santos-Silva J. (2026) *Eriosema* in Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil2020.jbrj.gov.br/FB29663 (accessed 28/January/2026).

Cardoso D.B.O.S., São-Mateus W.M.B. & Queiroz L.P. (2026) *Harpalyce in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB29715 (accessed 28/January/2026).

Castelletti C.H.M., Santos A.M.M., Tabarelli M. & Da Silva J.M.C. (2003) Quanto ainda resta da Caatinga? Uma estimativa preliminar (p. 719–734). *In*: Leal I.R., Tabarelli M. & da Silva J.M.C. (Eds.). Ecologia e conservação da Caatinga. Recife: Ed. Universitária da UFPE. 822 p.

Castello A.C.D., Pereira A.S.S., Simões A.O. & Koch I. (2026) *Aspidosperma in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB4520 (accessed 28/January/2026).

Castro A.A.J.F. & Martins F.R. (1999) Cerrados do Brasil e do Nordeste: Caracterização, área de ocupação e considerações sobre a sua fitodiversidade. *Pesquisa em Foco*, 7(9): 147–178.

Cavalcanti D. & Tabarelli M. (2004) Distribuição das plantas Amazônico-nordestinas no Centro de Endemismo Pernambuco: Brejos de Altitude *vs.* Florestas de Terras Baixas (p. 285–296). *In*: Porto K.C., Cabral J.J.P. & Tabarelli M. (Orgs.). Brejos de Altitude em Pernambuco e Paraíba: história natural, ecologia e conservação. Brasília: Ministério do Meio Ambiente. 324 p.

Chautems A. & Perret M. (2013) Redefinition of the Neotropical genera *Codonanthe* (Mart.) and *Codonanthopsis* Mansf. (Gesneriaceae). *Selbyana*, 31: 143–156.

Chautems A. & Rossini J. (2026) *Codonanthe in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB7822 (accessed 28/January/2026).

CNCFlora (2025) Painel de Dados do Centro Nacional de Conservação da Flora. https://cncflora.jbrj.gov.br/ (accessed 18/March/2025).

Cody M.L. (1986) Diversity, rarity, and conservation in mediterranean-climate regions (p. 122–152). *In:* Soulé M.E. (Ed.). Conservation biology: the science of scarcity and diversity, Sunderland: Sinauer Associates. 584 p.

CONDEPE - Agência Estadual de Planejamento e Pesquisas de Pernambuco (2011) Pernambuco em mapas. Recife: CONDEPE/FIDEM. 159 p.

Costa I.R., Araújo F.S. & Lima-Verde L.W. (2004) Flora e aspectos auto-ecológicos de um encrave de cerrado na chapada do Araripe, Nordeste do Brasil. *Acta Botanica Brasilica*, 18: 759–770. https://doi.org/10.1590/S0102-33062004000400006

CPRH - Agência Estadual de Meio Ambiente (2014) Atlas Ambiental do estado de Pernambuco. Recife: CPRH, ITEP. 205 p.

CRIA - Centro de Referência em Informação Ambiental (2025) SpeciesLink network. https://specieslink.net/search/ (accessed 07/April/2025).

Diniz M., Souza A., Medeiros D., Oliveira A. & Silva S. (2022) Cerrado enclave and the update of the mapping of landscape units in the state of Rio Grande do Norte. *Mercator*, 21: e21014. https://doi.org/10.4215/rm2022.e21014

Eggers L. & Inácio C.D. (2026) *Sisyrinchium in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB17835 (accessed 28/January/2026).

Eiten G. (1978) Delimitation of the cerrado concept. *Vegetation*, 36: 169–178.

Fava W.S., Costa P.C. & Lorenz A.P. (2020) Ecological niche modelling and genetic analyses reveal lack of geographic differentiation of *Leptolobium dasycarpum* (Leguminosae, Papilionoideae) across the Brazilian savannah. *Flora* 264: 151566. https://doi.org/10.1016/j.flora.2020.151566

Fernandes A. (2000) Fitogeografia brasileira. Fortaleza: Multigraf. 340 p.

Fernandez E. & Moraes M. (2019) *Handroanthus cristatus* (Bignoniaceae). Lista Vermelha da Flora Brasileira: Centro Nacional de Conservação da Flora, Instituto de Pesquisas Jardim Botânico do Rio de Janeiro. http://cncflora.jbrj.gov.br/portal/pt-br/profile/Handroanthus%20cristatus (accessed 17/March/2025).

Flora e Funga do Brasil (2026) Jardim Botânico do Rio de Janeiro. http://floradobrasil.jbrj.gov.br/ (accessed 20/February/2026).

Forzza R.C., Baumgratz J.F.A., Bicudo C.E.M., Canhos D.A.L., Carvalho Junior A.A., Costa A., Costa D.P., Hopkins M., Leitman P.M., Lohmann L.G., Lughadha E.N., Maia L.C., Martinelli G., Menezes M., Morim M.P., Coelho M.A.N., Peixoto A.L., Pirani J.R., Prado J., Queiroz L.P., Souza S., Souza V.C., Stehmann J.R., Sylvestre L.S., Walter B.M.T. & Zappi D.C. (2010) Introdução: Síntese da diversidade brasileira (p. 19–42). *In*: Forzza R.C. et al. (Orgs). Catálogo de plantas e fungos do Brasil. Rio de Janeiro: Andrea Jakobsson Estúdio, Instituto de Pesquisas Jardim Botânico do Rio de Janeiro. 875 p.

Garcia F.C.P. & Bonadeu F. (2026) *Inga in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB22803 (accessed 28/January/2026).

Gentry A.H. (1992) Bignoniaceae: Part II (Tribe Tecomeae). *Flora Neotropica*, 25: 1–370.

Gonçalves B.L.M., Cruz G.V., Lisboa M.A.N., Silva L.V.A., Queiroz M.G.S., Silva A.O., Teixeira M.R.A., Silva M.A.P., Sampaio V.S., Rocha L.S.G. & Calixto Júnior J.T. Flora and biological spectrum of a savanna enclave within the semiarid Caatinga Dominion in Ceará state, Northeastern Brazil. *South African Journal of Botany*, 175: 587–599. https://doi.org/10.1016/j.sajb.2024.10.033

Google Earth (2026) Version Pro 7.3. https://earth.google.com/ (accessed 29/January/2026).

Haynes J.L. (1970) Uso agrícola dos tabuleiros costeiros do Nordeste do Brasil: um exame das pesquisas, 2° edição. Recife: SUDENE 9–25. 139 p.

Hopkins H.C.F. (1986) *Parkia* (Leguminosae: Mimosoideae). *Flora Neotropica*, 43: 1–123.

IBGE (2019) Províncias estruturais, compartimentos de relevo, tipos de solos e regiões fitoecológicas, Rio de Janeiro: IBGE. 179 p.

IBGE (2023) Biomas. https://www.ibge.gov.br/geociencias/cartas-e-mapas/informacoes-ambientais/15842-biomas.html (accessed 20/November/2023).

IUCN Standards and Petitions Committee (2024) Guidelines for Using the IUCN Red List Categories and Criteria. Version 16. Prepared by the Standards and Petitions Committee. https://www.iucnredlist.org/resources/redlistguidelines (accessed 08/May/2025).

Judd W.S. (1995) *Agarista. In*: Ericaceae-Part II. The superior-ovaried genera (Monotropoideae, Pyroloideae, Rhododendroideae, and Vaccinioideae p.p.). *Flora Neotropica*, 66: 295–344.

Kimmel T., Piechowski D. & Gottsberger G. (2008) The history of fragmentation of the lowland Atlantic Forest of Pernambuco, Brazil. *Bioremediation, Biodiversity and Bioavailability*, 2: 1–4.

Klink C.A. & Machado R.B. (2005) A conservação do Cerrado brasileiro. *Megadiversidade*, 1: 147–155.

Labiak P.H. (2026) *Anemia in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB604198 (accessed 28/January/2026).

Lima L.A. & Bezerra-Filho C.R. (2010) Wind energy assessment and wind farm simulation in Triunfo – Pernambuco, Brazil. *Renew Energy*, 35: 2705–2713. https://doi.org/10.1016/j.renene.2010.04.019

Lohmann L.G. (2026) *Handroanthus in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB117444 (accessed 28/January/2026).

Macedo A., Alcantara C., Pessoa E. & Alves M. (2020) Flora da Usina São José, Igarassu, Estado de Pernambuco, Brasil: Acanthaceae, Gesneriaceae e Loganiaceae. *Hoehnea*, 47: e252019. https://doi.org/10.1590/2236-8906-25/2019

Machado R.B., Ramos Neto M.B., Pereira P.G.P., Caldas E.F., Gonçalves D.A., Santos N.S., Tabor K. & Steininger M. (2004) Estimativas de perda da área do Cerrado brasileiro, relatório técnico não publicado. Brasília: Conservação Internacional. 22 p.

Maciel J.R. & Costa-e-Silva M.B. (2011) Distribuição e taxonomia de *Andropogon* L. (Poaceae) em Pernambuco, Brasil. *Pesquisas, Botânica*, 62: 117–128.

Maciel N.G.P., Leite R.M.B., Santos S.E.B., Nascimento Junior J.A.A. & Costa A.M. (2024) Processos de vulnerabilização de empreendimentos eólicos em comunidade camponesa no Agreste Meridional de Pernambuco. *Saúde em Debate* 48: e8570. https://doi.org/10.1590/2358-28982024E18570P

Mamede M.C.H. et al. (2007) Livro vermelho das espécies vegetais ameaçadas de extinção no estado de São Paulo. São Paulo: Instituto de Botânica. 165 p.

Mapbiomas Project (2025) Collection 9 of the annual land cover and land use maps of Brazil (1985–2023). MapBiomas Data, V1. https://brasil.mapbiomas.org/en/colecoes-mapbiomas/ (accessed 13/April/2025).

Marhold K., Stuessy T., Agababian M., Agosti D., Alford M.H., Crespo A., Crisci J.V., Dorr L.J., Ferencová Z., Frodin D., Geltman D.V., Kilian N., Linder H.P., Lohmann L.G., Oberprieler C., Penev L., Smith G.F., Thomas W., Tulig M., Turland N. & Zhang X.-C. (2013) The Future of Botanical Monography: Report from an international workshop, 12–16 March 2012, Smolenice, Slovak Republic. *Taxon*, 62: 4–20. https://doi.org/10.1002/tax.621003

Martinelli G. & Moraes M.A. (2013) Livro vermelho da flora do Brasil. Rio de Janeiro: Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Andrea Jakobsson Estúdio. 1100 p.

Martinelli G., Martins E., Moraes M., Loyola R. & Amaro R. (2018) Livro Vermelho da Flora Endêmica do Estado do Rio de Janeiro. Rio de Janeiro: Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Andrea Jakobsson Estúdio. 456 p.

Martins E.M., Fernandes F.M., Maurenza D., Pougy N., Loyola R. & Martinelli G. (2014) Plano de ação nacional para a conservação do Faveiro-de-wilson (*Dimorphandra wilsonii* Rizzini). Rio de Janeiro: Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Andrea Jakobsson Estúdio. 52 p.

Mendonça M. & Lins L. (2000) Lista vermelha das espécies ameaçadas de extinção da flora de Minas Gerais. Belo Horizonte: Fundação Zoobotânica de Belo Horizonte, Fundação Biodiversitas. 157 p.

Mendonça N.A., Oliveira S.S., Aljahara J., Almeida T.E. & Fernandes R.S. (2024) Ferns and lycophytes in the *Cerrado*: a floristic study in eastern Maranhão, northeastern Brazil. *Rodriguésia*, 75: e00142024. https://doi.org/10.1590/2175-7860202475089

Morales J.F. & Zamora N.A. (2017) A synopsis of *Aspidosperma* (Apocynaceae) in Mexico and Central America with a taxonomic clarification of *Aspidosperma cruentum* and a new cryptic species. *Phytoneuron*, 68: 1–13.

Mori S.A., Boom B.M. & Prance G.T. (1981) Distribution patterns and conservation of eastern Brazilian coastal forest tree species. *Brittonia*, 33: 233–245.

Mota A.C., Alves L.J., Loureiro D.M., Santos E.S. & Carvalho-Sobrinho J. (2024) New records and conservation status of tree species from environmental licensing studies in highly human-modified areas in Bahia, northeastern Brazil. *Check List*, 20: 268–278. https://doi.org/10.15560/20.2.268

Myers N., Mittermeier R., Mittermeier C., Fonseca G.A.B. & Kent J. (2000) Biodiversity hotspots for conservation priorities. *Nature*, 403: 853–858. https://doi.org/10.1038/35002501

Nepomuceno I.V., Souza E.B., Zappi D.C., Moreira M.C., Nepomuceno F.Á.A. & Moro M.F. (2021) Savannas of the Brazilian semiarid region: what do we learn from floristics? *Acta Botanica Brasilica* 35: 361–380. https://doi.org/10.1590/0102-33062020abb0259

Oliveira A.C.P., Penha A.S., Souza R.F. & Loiola M.I.B. (2012) Composição florística de uma comunidade savânica no Rio Grande do Norte, Nordeste do Brasil. *Acta Botanica Brasilica*, 26: 559–569. https://doi.org/10.1590/S0102-33062012000300006

Oliveira L.C. & Hopkins M. (2026) *Parkia in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB83548 (accessed 28/January/2026).

Pereira A.S.S., Castello A.C.D., Simões A.O. & Koch I. (2019) Reestablishment, new records, and a key for the species of *Aspidosperma* (Apocynaceae) from the Brazilian Amazon. *Acta Botanica Brasilica*, 33: 1–20. https://doi.org/10.1590/0102-33062018abb0168

Pereira A.S.S., Simões A.O. & Santos J.U.M. (2016) Taxonomy of *Aspidosperma* Mart. (Apocynaceae, Rauvolfioideae) in the State of Pará, Northern Brazil. *Biota Neotropica*, 16: e20150080. https://doi.org/10.1590/1676-0611-BN-2015-0080

Porto K.C., Cabral J.J.P. & Tabarelli M. (2004) Brejos de altitude em Pernambuco e Paraíba: história natural, ecologia e conservação. Brasília: Ministério do Meio Ambiente. 324 p.

Prance G.T. (1979) Distribution patterns of lowland neotropical species with relation to history, dispersal and ecology with special reference to Chrysobalanaceae, Caryocaraceae and Lecythidaceae (p. 59–88). *In*: Larsen K. & Holm-Nielsen L.B. (Eds.). Tropical botany. London: Academic Press. 400 p.

QGIS (2023) QGIS Geographic Information System. QGIS Association. http://www.qgis.org (accessed 17/April/2025).

Ratter J.A., Bridgewater S. & Ribeiro J.F. (2003) Analysis of the floristic composition of the Brazilian cerrado vegetation III: Comparison of the woody vegetation of 376 areas. *Edinburgh Journal of Botany*, 60: 57–109. https://doi.org/10.1017/S0960428603000064

Ratter J.A., Ribeiro J.F. & Bridgewater S. (1997) The Brazilian Cerrado vegetation and threats to its biodiversity. *Annals of Botany*, 80: 223–230.

Rees M., Godlee J.L., Harris D.J., Ryan C.M. & Dexter K.G. (2023) Testing White's floristic impoverishment hypothesis in the forest-savanna transition zones of Africa. *Diversity*, 15: 833. https://doi.org/10.3390/d15070833

Reflora (2026) Herbário Virtual. Disponível em: https://floradobrasil.jbrj.gov.br/reflora/herbarioVirtual/ (accessed 28/May/2026)

Renvoize S.A. (1981) The genus *Calliandra* (Leguminosae) in Bahia, Brazil. *Kew Bulletin*, 36: 63–83.

Ribeiro E.M.S., Arroyo-Rodríguez V., Santos B.A., Tabarelli M. & Leal I.R. (2015) Chronic anthropogenic disturbance drives the biological impoverishment of the Brazilian Caatinga vegetation. *Journal of Applied Ecology*, 52: 611–620. https://doi.org/10.1111/1365-2664.12420

Ribeiro E.M.S., Lohbeck M., Santos B.A., Arroyo-Rodríguez V., Tabarelli M. & Leal I.R. (2019) Functional diversity and composition of Caatinga woody flora are negatively impacted by chronic anthropogenic disturbance. *Journal of Ecology*, 107: 2291–2302. https://doi.org/10.1111/1365-2745.13177

Ribeiro E.M.S., Santos B.A., Arroyo-Rodríguez V., Tabarelli M., Souza G. & Leal I.R. (2016) Phylogenetic impoverishment of plant communities following chronic human disturbances in the Brazilian Caatinga. *Ecology*, 97: 1583–1592. https://doi.org/10.1890/15-1122.1

Rizzini C.T. (1997) Tratado de fitogeografia do Brasil: aspectos ecológicos, sociológicos e florísticos. Rio de Janeiro: Âmbito Cultural Edições Ltda. 747 p.

Rodrigues R.S. (2026) *Leptolobium in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB83279 (accessed 28/January/2026).

Rodrigues R.S. & Tozzi A.M.G.A. (2012) Revisão taxonômica de *Leptolobium* (Papilionoideae, Leguminosae). *Acta Botanica Brasilica*, 26: 146–64. https://doi.org/10.1590/S0102-33062012000100016

Romão G.O., Cabral A., Santos F.B.D. & Kinoshita L.S. (2026) *Agarista in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB111683 (accessed 28/January/2026).

Ross H. & Crisp M.D. (2005) Brongniartieae (p. 253–259). *In*: Lewis G.P., Schrire B., Mackinder B. & Lock M. (Eds.). Legumes of the World. Richmond: Royal Botanic Gardens Kew. 577 p.

Santos A.M.M. & Tabarelli M. (2004) Integridade, esforço e diretrizes para Conservação dos Brejos de Altitude da Paraíba e Pernambuco (p. 309–318). *In*: Porto K.C, Cabral J.J.P. & Tabarelli M. (Orgs.). Brejos de altitude em Pernambuco e Paraíba: história natural, ecologia e conservação. Brasília: Ministério do Meio Ambiente, Universidade Federal de Pernambuco. 324 p.

Santos L.S., Silva H.P.B. & Pereira E.C.G. (2014) Cerrado em área disjunta em brejo de altitude no agreste pernambucano, Brasil. *Boletim Goiano de Geografia*, 34: 337–353. https://doi.org/10.5216/bgg.v34i2.31735

São-Mateus W.M.B., Queiroz L.P., Jardim J.G. & Cardoso D.B.O.S. (2018) *Harpalyce riparia* (Leguminosae, Papilionoideae), a new species from the campos rupestres of the Chapada Diamantina in Bahia, Brazil. *Systematic Botany*, 43: 206–211. https://doi.org/10.1600/036364418X697102

Silva M.C., Moonlight P., Oliveira R.S., Pennington R.T. & Lucy R. (2022) Toward diverse seed sourcing to upscale ecological restoration in the Brazilian Cerrado. *Frontiers in Ecology and Evolution*, 10: 1045591. https://doi.org/10.3389/fevo.2022.1045591

Simon M.F., Grether R., Queiroz L.P., Skema C., Pennington R.T. & Hughes C.E. (2009) Recent assembly of the Cerrado, a Neotropical plant diversity hotspot, by *in situ* evolution of adaptations to fire. *Proceedings of the National Academy of Sciences of the United States of America*, 106: 20359–20364. https://doi.org/10.1073/pnas.0903410106

Simon M.F. & Pennington T. (2012) Evidence for adaptation to fire regimes in the tropical savannas of the Brazilian Cerrado. *International Journal of Plant Sciences*, 173(6): 711–723. https://doi.org/10.1086/665973

Simonelli M. & Fraga C.N. (2007) Espécies da flora ameaçadas de extinção no estado do Espírito Santo. Vitória: IPEMA. 144 p.

Souza V.C. (2026) Orobanchaceae *in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB12425 (accessed 28/January/2026).

Tabarelli M., Aguiar A.V., Grillo A. & Santos A. (2006) Fragmentação e perda de habitat na floresta Atlântica ao norte do Rio São Francisco (p. 80–99). *In*: Siqueira Filho J.A. & Leme E. (Orgs.). Fragmentos de Mata Atlântica do Nordeste: Biodiversidade, Conservação e suas Bromélias. Rio de Janeiro: Andrea Jakobsson Estúdio. 415 p.

Trindade M.B., Lins-e-Silva A.C., Silva H.P., Figueira S.B. & Schessl M. (2008) Fragmentation of the Atlantic rainforest in the northeast coastal region of Pernambuco, Brazil: recent changes and implications for conservation. *Bioremediation, Biodiversity and Bioavailability*, 2: 5–13.

Viana V.M., Tabanez A.A.J. & Batista J.L. (1997) Dynamic and restoration of forest fragments in the Brazilian Atlantic moist forest (p. 351–365). *In*: Laurance W. & Bierregaard-Jr R. (Eds.). Tropical Forest Remnants: Ecology, Management, and Conservation of Fragmented Communities. Chicago and London: The University of Chicago Press. 632 p.

Vieira L.T.A., Castro A.A.J.F., Coutinho J.M.C.P., de Sousa S.R., de Farias R.R.S., Castro N.M.C.F. & Martins F.R. (2019) A biogeographic and evolutionary analysis of the flora of the North-eastern cerrado, Brazil. *Plant Ecology and Diversity*, 12: 475–488. https://doi.org/10.1080/17550874.2019.1649311