

Angiosperms from the Araripe National Forest, Ceará, Brazil

Suelma Ribeiro-Silva^{1*}, Marcelo Brilhante de Medeiros², Beatriz Machado Gomes², Emília Naiana Costa Seixas³ and Maria Arlene Pessoa da Silva³

1 Instituto Chico Mendes de Conservação da Biodiversidade, Centro Nacional de Pesquisa e Conservação da Biodiversidade do Cerrado e Caatinga. EQSW 103/104, Bloco C, Sudoeste. CEP 70670-350. Brasília, DF, Brazil.

2 Embrapa Recursos Genéticos e Biotecnologia, Herbário. Av. W5 Norte (final), Parque Estação Biológica, s/n°. CEP 70770-917. Brasília, DF, Brazil.

3 Universidade Regional do Cariri, Herbário Caririense Dardo de Andrade-Lima. Rua Cel. Antônio Luís, 1162. CEP 63100-000. Crato, CE, Brazil.

* Corresponding author. E-mail: suelma.ribeirosilva@gmail.com

ABSTRACT: This study provides a species list of the angiosperms from the Araripe National Forest (ANF) in the south part of Ceará state, northeastern Brazil. The floristic survey recorded 188 species from 55 Angiosperm families. The most species-rich families were Fabaceae (31), Rubiaceae (17), Asteraceae (14), Bignoniaceae (10), Myrtaceae (9), Euphorbiaceae (7), Apocynaceae and Malpighiaceae (7) and Annonaceae and Solanaceae (5). The flora of the ANF is composed of typical species from the vegetation physiognomies of Cerrado sensu lato such as *cerradão* and *cerrado sensu stricto* and it is influenced by the northeastern phytogeographic Cerrado province. Furthermore, there are influences of ecotones between these physiognomies, seasonal forests and *carrascos* within the Caatinga biome. In addition to four threatened species that were recorded, the ANF also harbors species that represent important incomes for local communities because of the non-timber forest products, such as *Dimorphandra gardneriana* Tul. and *Caryocar coriaceum* Wittm..

INTRODUCTION

The *cerrado* (a Neotropical savanna) in northeastern Brazil occurs in areas with altitudes up to 500 m in the states of Piauí and Maranhão (Castro and Martins 1999; Castro *et al.* 2007), on coastlines of the *Barreiras* Formation (coastal plains) in the states of Pernambuco, Paraíba and Ceará (Fernandes 1990; Oliveira-Filho and Carvalho 1993; Moro *et al.* 2011) and in isolated patches (enclaves) within the *Caatinga* biome in altitudes higher than 800 m (Costa *et al.* 2004; Costa and Araújo 2007).

The *cerrado* in northeastern Brazil is also considered peripheral or marginal since it is located at the extreme of the distribution area of the biome (Castro 1994). These areas are physiognomically and structurally an extension of the *cerrados* of the Central Plateau of Brazil (Castro 1996; Castro *et al.* 2007). Castro and Martins (1999) pointed out that there are two climatic barriers that cut across the region of *cerrados* between its southern limits and the Central Plateau and between these *cerrados* and those occurring in Brazilian northeastern: the occurrence of frost in the *Cerrados* of southeastern Brazil and the severe droughts in the northeastern Brazil.

The flora of the Araripe National Forest (ANF) comprises species typical from the phytogeographical of the *Cerrado* domain such as *cerradão* and *cerrado sensu stricto* and it is influenced by the north-northeastern phytogeographic *Cerrado* province (Ratter *et al.* 2003). This province comprises areas of *cerrados* in the states of Ceará, Piauí, southern Maranhão, western Tocantins and eastern Bahia (Ratter *et al.* 2003).

The ANF is a protected area for sustainable use that was established in 1960 in the state of Ceará (IBAMA 2004). It is located on the Araripe Plateau and is among the 82 priority areas for biodiversity conservation in the *Caatinga* biome and among the 27 areas of high biological

importance with priorities for biological surveys (Silva *et al.* 2004).

The first records on the flora of the Araripe Plateau were carried out by the British naturalist George Gardner in 1838 (Gardner 1975). Gardner collected a number of plant species in this region and some were described by him, such as *Allamanda violacea* Gardner and *Mouriri pusa* Gardner (Gardner 1975). Recently, there have been other scientific surveys of the flora of the ANF and Araripe Plateau (Ratter *et al.* 2003; Costa *et al.* 2004; Costa and Araújo 2007; Alencar *et al.* 2007). However, there are still many gaps in biotic information, and this has made it more difficult to implement some management and conservation actions in the ANF. The aim of this study was to provide a species list of the Angiosperm flora of the ANF in order to extend information on the local flora and on the protected areas within the northeastern Brazil.

MATERIALS AND METHODS

Study Site

The Araripe National Forest (ANF) is located on the Araripe Plateau (*Chapada do Araripe*), in the southern tip of the state of Ceará in northeastern Brazil, covering a total area of 38.626 ha. This protected area cross the municipalities of Santana do Cariri, Crato, Jardim and Barbalha and extends from latitudes 07°11'42" to 07°28'38" S and longitudes 39°13'28" to 39°36'33" W (Figure 1).

The ANF is under the influence of wet and hot tropical climate with a rainy season from January to May. The mean annual temperature is 24° a 26°C and the mean annual rainfall is 1090.9 mm (IPECE 2012).

The vegetation of the ANF comprises some of the physiognomies found in the *Cerrado* domain such as the *cerrado sensu stricto* (07°23'50.22" S, 39°20'40.44" W) and

the *cerradão* (07°23'58.74" S, 39°20'0.18" W) (Ribeiro and Walter 2008). Furthermore, there are also the *carrasco* (07°12' 43" S, 39°36' 23" W) and the semideciduous seasonal forests (07°16'31.8" S, 39°27'12.8" W) (Figures 2 and 3). In ANF the *carrasco* is associated with patches of dystrophic latosols and hydromorphic laterites, while the *cerrado sensu stricto* and *cerradão* are associated with dystrophic latosols (IBAMA 2004).

The forested areas located on the northern and northeastern slopes of the ANF were defined as *matas úmidas* associated with dystrophic and eutrophic lithosols (IBAMA 2004), or humid forests. However these areas may be more clearly described as semideciduous seasonal forests, if we take into account the region's climatic characteristics (IBGE 1992). This second type of classification is in accordance with the Vegetation Map of Brazil (IBGE 2004), which records the occurrence of ecotones on the Araripe Plateau, with transitions between savanna-seasonal forests and steppe savanna-seasonal forests.

Data Collection

The floristic survey used the random-walk method (Filgueiras *et al.* 1994) across all the vegetation physiognomies in the ANF, with geo-referenced sample stations (see vegetation map for sample stations sites). The study was carried out on 10 expeditions from October 2007 to December 2008 and comprised both dry and wet seasons. All specimens in reproductive phase were collected and subsequently incorporated into the Dárdano de Andrade-Lima Cariri Regional University Herbarium (HCDAL) in accordance with the usual methodology (Mori *et al.* 1985). Specimen vouchers are shown in Table 1.

Species identification was carried out according to herbarium references (CEN, UB, HEPH, IBGE, HCDAL), specific literature and by consulting experts. The floristic survey followed the Angiosperm Phylogeny Group III (APG III 2009). The Chico Mendes Institute for Biodiversity Conservation-ICMBio provided the research permit (15495/2008).

RESULTS AND DISCUSSION

This study surveyed all vegetation physiognomies within the Araripe National Forest - ANF (Figure 3). A total of 188 species from 55 families of angiosperms were recorded (Table 1; see also some species in Figure 4). The most species-rich families were Fabaceae (31), Rubiaceae (17), Asteraceae (14), Bignoniaceae (10), Myrtaceae (9), Euphorbiaceae (7), Apocynaceae and Malpighiaceae (7) and Annonaceae and Solanaceae (5). Together, the other 45 families comprised 76 species.

Among the 188 species recorded within ANF, 124 (65.9%) species also occur in the *Caatinga* biome. This is a expected result since the isolated *cerrado* patches in the state of Ceará are related to climatic changes in the past that have caused expansion and contraction of this dominant vegetation in Central Brazil (Fernandes 1990) and the ANF is surrounded by *Caatinga*'s vegetation.

As regards the species richness in the ANF, Costa *et al.* (2004) and Costa and Araújo (2007) reported 59 and 43 species respectively associated with the shrub and the woody layer in the *cerrado*. These results provide richness

values lower than in the core area and the isolated *cerrados* in São Paulo (Ratter *et al.* 2003). The isolated and peripheral areas of *cerrados* such as in the state of Paraná and Amazônia also have diversity patterns of woody species lower than in the core area, the peripheral areas of Xingu, Araguaia and Tocantins River basins and the isolated *cerrados* in São Paulo (Ratter *et al.* 2003). The results in Table 1 added 38 new records associated with *cerrado sensu stricto* comprising woody and herbaceous species on the lists of Costa *et al.* (2004) and Costa and Araújo (2007). However, these studies adopted different sampling methods that make it difficult to compare areas, so more sampling efforts are still required on the Araripe Plateau to reach a better understanding of its species richness.

The *cerrados* of ANF presented floristic patterns of the north-northeastern province of the biome in accordance with Ratter *et al.* (2003). The species *Hirtella ciliata* Mart. and Zucc., *Caryocar coriaceum* Wittm., *Parkia platycephala* Benth., *Dimorphandra gardneriana* Tul. and *Platonia insignis* Mart. (Table 1) are restricted to this province

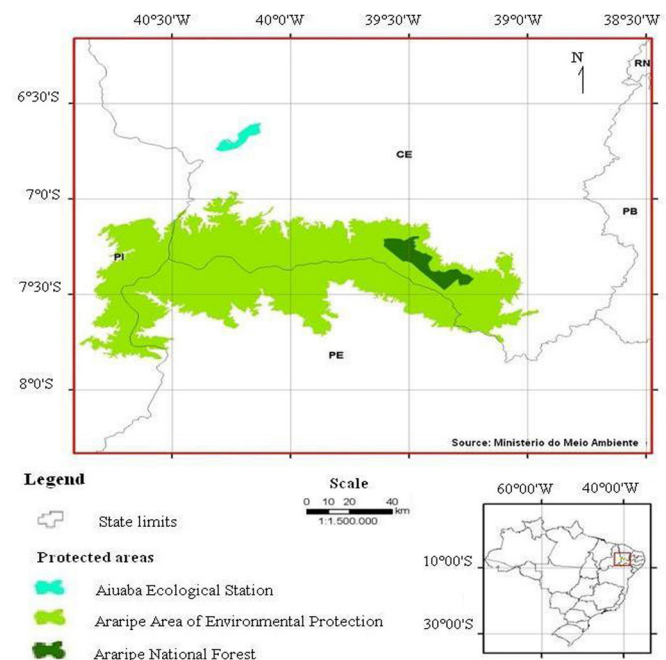


FIGURE 1. Study area at the Araripe National Forest, Ceará, Brazil. Source: Ministério do Meio Ambiente.

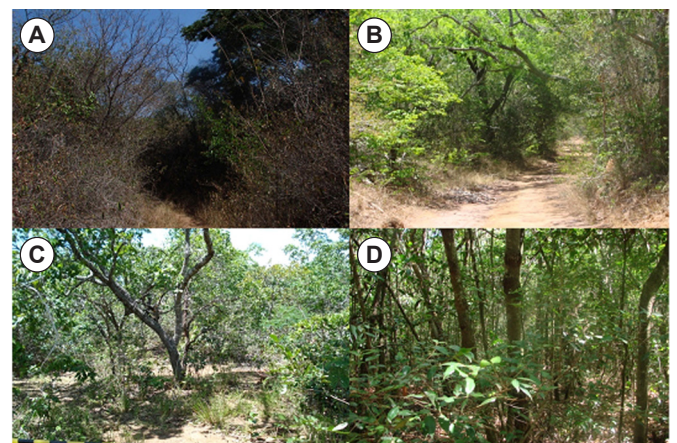


FIGURE 2. Vegetation physiognomies in the Araripe National Forest, CE, Brazil. A) *Carrasco*; B) *Cerradão*; C) *Cerrado sensu stricto*; D) Semideciduous seasonal forest (Archives of Araripe-PBBI Project).

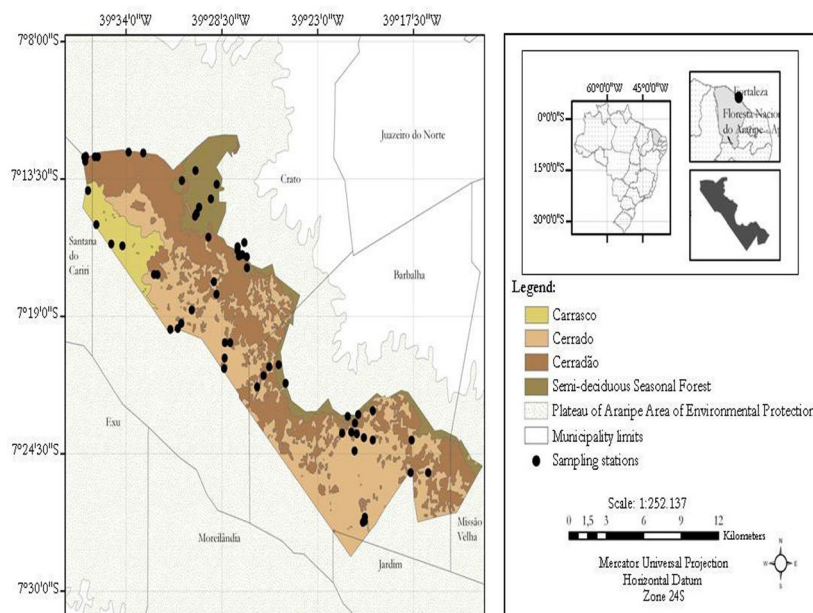


FIGURE 3. Vegetation map of the Araripe National Forest, CE, Brazil (adapted from IBAMA 2004).

(Ratter *et al.* 2003; Bridgewater *et al.* 2004), and also occur in some coastal *cerrados* (Moro *et al.* 2001). These species were observed in areas of *cerrado sensu stricto* and *cerradão* (Table 1; Costa *et al.* 2004; Costa and Araújo 2007; Alencar *et al.* 2007).

Costa and Araújo (2007) observed that among the species with highest coverage in the ANF, *Byrsonima sericea* DC. and *Qualea parviflora* Mart. are also widespread species in the *Cerrado* biome. *Qualea parviflora* is also considered a widespread species in the peripheral *cerrados* of northeastern Brazil (Castro *et al.* 2007). In addition to these species, the following ones occur both at ANF and are widely distributed in the *Cerrado* biome (Ratter *et al.* 2003): *Anacardium occidentale* L., *Annona coriacea* Mart., *Byrsonima coccolobifolia* Kunth., *Bowdichia virgilioides* Kunth., *Casearia grandiflora* Cambess., *Cydistax antispyphillica* (Mart.) Mart., *Duguetia furfuracea* (A. St.-Hil.) Saff., *Hancornia speciosa* Gomez, *Jacaranda brasiliana* (Lam.) Pers., *Ouratea hexasperma* (A. St.-Hil.) Baill., *Plathymenia reticulata* Benth., *Roupala montana* Aubl., *Simarouba amara* Aubl., *Stryphnodendron rotundifolium* Mart. and *Tabebuia ochracea* (Cham.) Standl..

Species such as *Senegalia langsdorffii* Benth., *Hymenaea eriogyne* Benth. and *Manihot caerulescens* Pohl. were observed in the *carrasco* of the ANF (Table 1). These species were also observed in the *carrascos* of the Ibiapaba Plateau, in the state of Ceará (Araújo *et al.* 1999). The species *S. langsdorffii* was the most abundant and the one with the highest importance value in this area (Araújo *et al.* 1999).

The remnants of the seasonal semideciduous forests located above 700 m in the ANF are defined as the *Montana* (mountain) subtype (IBGE 1992). This vegetation physiognomy comprise species such as *Byrsonima sericea* DC, *Simarouba amara* Aubl., *Hirtella ciliata* Mart. and Zucc., *Hirtella gracilipes* (Hook. F.) Prance, *Vismia guianensis* (Aubl.) Pers., *Xylopia laevigata* R.W.Fr. and *Zanthoxylum gardneri* Engl. at the ANF.

The occurrence of *B. virgilioides* in the *cerradões* of the ANF (Table 1) indicates a more dystrophic *cerradão*,

according to the soil type and to the characteristic species defined by Ratter (1971) and Araújo *et al.* (2001). Alencar *et al.* (2007) also noted *B. virgilioides* with high importance value at the *cerradões* of the Araripe Plateau. However, other species observed in this area, such as *Anadenanthera colubrina* (Vell.) Brenan and *Magonia pubescens* A. St. Hil. (Table 1), also indicate mesotrophic *cerradões* (Ratter *et al.* 2006) and could indicate transition to the seasonal semideciduous forests.

As regards the threatened species, there are three that are included on the IUCN list (IUCN 2012) (Table 1): *Caryocar coriaceum* Wittm., *Chrysophyllum arenarium* Allemão and *Lafoensia pacari* A. St.. Besides these threatened species, the *cerrado* remnants of the ANF also harbor species that are targets for harvesting activities associated with non-timber forest products of local and regional trade importance. *Caryocar coriaceum* Wittm. (*piqui*), *Dimorphandra gardneriana* Tul (*faveira*), *Himatanthus drasticus* (Mart.) Plumel (*janaguba*) and *Stryphnodendron polyphyllum* Mart. (*barbatimão*) are some of the species that provide income to the communities resident near ANF (IBAMA 2004).

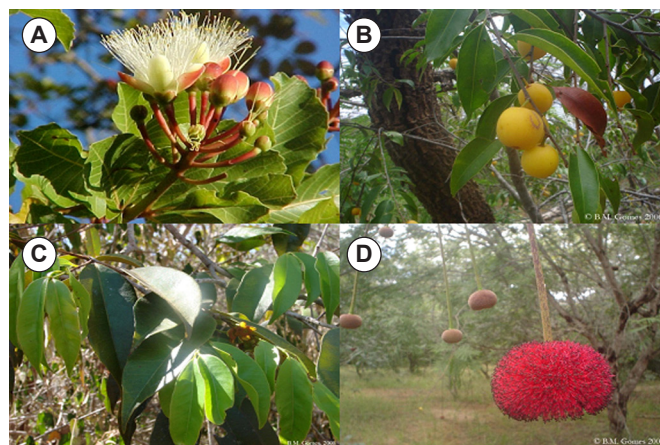


FIGURE 4. Some species collected in the Araripe National Forest, CE, Brazil. a) *Caryocar coriaceum* Wittm. b) *Chrysophyllum arenarium* Allemão c) *Psidium* sp. new, d) *Parkia platycephala* Benth. (Photographs "a" by Suelma Ribeiro-Silva; Photographs "b" and "c" by Beatriz Gomes).

This study differs from the previous surveys (Costa et al. 2004; Costa and Araújo 2007) since it provided additional data on the flora of the ANF from all vegetation physiognomies, showing that it harbors representative species of the north-northeastern *Cerrado* province, comprising remnants of *cerrado stricto sensu*, *cerradão*,

carrasco and seasonal semideciduous forests under the influence of the *Caatinga* biome. A number of the recorded species in the ANF also occur in the *Caatinga*, besides the *Cerrado* biome. Furthermore, this study provides the first species records for some vegetation physiognomies in the ANF such as the *carrasco*.

TABLE 1. Angiosperm species recorded in the Araripe National Forest, Ceará, Brazil. Cerr = *cerrado sensu stricto*; Car = *carrasco*; Cerd = *cerradão*; Fes = semideciduous seasonal forest.

FAMILY/SPECIES	HABIT	PHYSIOGNOMY				VOUCHERS
		Cerr	Car	Cerd	Fes	
ALSTROMERIACEAE						
<i>Alstroemeria piauhyensis</i> Gardner	herb				x	Gomes B.M. 410
ANACARDIACEAE						
<i>Anacardium occidentale</i> L.	tree				x	Silva M.A.P. 1432
ANNONACEAE						
<i>Annona coriacea</i> Mart.	shrub	x				Gomes B.M. 477
<i>Annona leptopetala</i> (R.E.Fr.) H.Rainer	tree			x		Silva M.A.P. s/n
<i>Duguetia fufuracea</i> (A.St.-Hil.) Saff	shrub		x		x	Silva M.A.P. 1483, Silva M.A.P. s/n
<i>Ephedranthus parviflorus</i> S. Moore	tree		X			Seixas E.N.C. s/n
<i>Xylopia laevigata</i> (Mart.) R.E.Fr.	tree	x	X			Seixas E.N.C. s/n, Silva M.A.P. s/n
APOCYNACEAE						
<i>Ditassa capillaris</i> E. Fourn.	vine		x			Seixas E.N.C. s/n
<i>Hancornia speciosa</i> Gomes	tree	x				Alencar A.L. s/n
<i>Himatanthus drasticus</i> (Mart.) Plumel	tree	x				Seixas E.N.C. s/n
<i>Prestonia solanifolia</i> (Müll. Arg.) Woodson	vine		x			Seixas E.N.C. s/n
<i>Secondatia floribunda</i> A. DC.	vine		x			Cartaxo S.L. s/n
<i>Tabernaemontana catharinensis</i> A. DC.	tree		x			Seixas E.N.C. s/n
<i>Temnadenia violacea</i> (Vell.) Miers	vine	x	x			Cartaxo S.L. s/n, Seixas E.N.C. s/n
ASTERACEAE						
<i>Acanthospermum hispidum</i> DC.	herb		x			Gomes B.M. s/n
<i>Achyrocline satureioides</i> (Lam.) DC.	shrub	x				Silva M.A.P. 1440
<i>Ageratum longifolium</i> (Gardner) Benth. ex Baker	shrub	x				Silva M.A.P. 1518, Silva M.A.P. s/n
<i>Ayapana amygdalina</i> (Lam.) R.M. King and H. Rob.	vine	x				Silva M.A.P. 1424
<i>Baccharis trinervis</i> Pers.	herb	x				Seixas E.N.C. s/n, Silva M.A.P. 1507
<i>Calea hymenolepsis</i> Baker	herb	x	x			Seixas E.N.C. s/n, Silva M.A.P. s/n
<i>Dasyphyllum</i> sp.1	shrub	x				Silva M.A.P. 1448
<i>Emilia sonchifolia</i> (L.) DC. ex Wight	herb				x	Seixas E.N.C. s/n
<i>Eremanthus pohlii</i> (Baker) MacLeish	tree				x	Silva M.A.P. 1431
<i>Gochnatia blanchetiana</i> (DC.) Cabrera	tree	x	x			Cartaxo S.L. s/n, Gomes B.M. 414
<i>Lepidaploa remotiflora</i> (Rich.) H. Rob.	subshrub		x			Seixas E.N.C. s/n
<i>Pectis oligocephala</i> (Gardner) Sch.Bip.	herb				x	Seixas E.N.C. s/n
<i>Tilesia baccata</i> (L.f.) Pruski	shrub			x		Silva M.A.P. s/n
<i>Verbesina diversifolia</i> DC.	shrub		x			Gomes B.M. s/n
BIGNONIACEAE						
<i>Anemopaegma laeve</i> DC.	vine		x		x	Seixas E.N.C. s/n, Seixas E.N.C. s/n
<i>Bignonia corymbosa</i> (Vent.) L. G. Lohmann	vine			x		Seixas E.N.C. s/n
<i>Cybistax antisiphilitica</i> (Mart.) Mart.	tree		x			Silva M.A.P. s/n
<i>Fridericia chica</i> (Bonpl.) L.G.Lohmann	vine	x				Silva M.A.P. s/n
<i>Handroanthus ochraceus</i> (Cham.) Mattos	tree	x				Gomes B.M. 474
<i>Handroanthus serratifolius</i> (A.H. Gentry) S. Grose	tree		x			Silva M.A.P. 1488
<i>Jacaranda brasivine</i> (Lam.) Pers.	tree		x			Silva M.A.P. 1499
<i>Lundia cordata</i> (Vell.) DC.	vine		x			Seixas E.N.C. s/n
<i>Pleonotoma stichadenia</i> K. Schum.	vine		x			Gomes B.M. 468, Seixas E.N.C. s/n
<i>Pyrostegia venusta</i> (Ker Gawl.) Miers	vine		x		x	Silva M.A.P. s/n, Gomes B.M. 472
BORAGINACEAE						
<i>Cordia rufescens</i> A. DC.	tree		x			Seixas E.N.C. s/n
<i>Tournefortia membranacea</i> (Gardner) DC.	vine		x			Seixas E.N.C. s/n
<i>Varronia</i> cf. <i>multispicata</i> (Cham.) Borhidi	shrub		x			Seixas E.N.C. s/n
<i>Varronia harleyi</i> (Taroda) J.S. Mill.	shrub	x				Silva M.A.P. s/n
BURSERACEAE						
<i>Protium heptaphyllum</i> (Aubl.) Marchand	tree				x	Gomes B.M. 457

TABLE 1. CONTINUED.

FAMILY/SPECIES	HABIT	PHYSIOGNOMY				VOUCHERS
		Cerr	Car	Cerd	Fes	
CACTACEAE						
<i>Cereus jamacaru</i> DC.	tree		x			Seixas E.N.C. s/n
CARYOCARACEAE						
<i>Caryocar coriaceum</i> Wittm.	tree	x				Gomes B.M. 421, Silva M.A.P. 1410
CELASTRACEAE						
<i>Maytenus</i> cf. <i>distichophylla</i> Mart. ex Reissek	tree		x			Seixas E.N.C. s/n
CHRYSOBALANACEAE						
<i>Hirtella ciliata</i> Mart. and Zucc.	tree			x	x	Gomes B.M. 463, Silva M.A.P. 1460
<i>Hirtella gracilipes</i> (Hook. f.) Prance	tree				x	Gomes B.M. 451, Silva M.A.P. 1459
<i>Licania</i> sp.1	tree				x	Silva M.A.P. 1461
COMBRETACEAE						
<i>Buchenavia tetraphylla</i> (Aubl.) R.A. Howard	tree		x	x		Alencar A.L. 99, Figueiredo J.M. s/n
CONNARACEAE						
<i>Connarus detersus</i> Planch.	tree				x	Cartaxo S.L. s/n
CONVOLVULACEAE						
<i>Calycolobus</i> aff. <i>lanulosus</i> D.F. Austin	vine		x			Santos A.C.B. s/n
<i>Merremia macrocalyx</i> (Ruiz and Pav.) O'Donell	vine				x	Silva M.A.P. 1429
CYPERACEAE						
<i>Rhynchospora exaltata</i> Kunth	herb	x				Silva M.A.P. s/n
ERYTROXYLACEAE						
<i>Erythroxylum barbatum</i> O.E. Schulz	shrub	x				Gomes B.M. 476, Silva M.A.P. s/n
<i>Erythroxylum deciduum</i> A. St.-Hil.	shrub	x				Silva M.A.P. s/n
<i>Erythroxylum stipulosum</i> Plowman	shrub		x			Silva M.A.P. 4303
EUPHORBIACEAE						
<i>Astraea lobata</i> (L.) Klotzsch	herb				x	Oliveira I.G. s/n
<i>Croton glandulosus</i> L.	shrub	x	x			Silva M.A.P. s/n, Silva M.A.P. s/n
<i>Croton</i> sp.1	subshrub				x	Silva M.A.P. 1517
<i>Manihot caerulescens</i> Pohl	shrub	x				Silva M.A.P. s/n, Silva M.A.P. 1464
<i>Maprounea guianensis</i> Aubl.	tree			x		Alencar A.L. 97
<i>Microstachys daphnoides</i> (Mart.) Müll. Arg.	shrub	x	x			Santos A.C.B. s/n, Silva M.A.P. s/n
not identified	subshrub	x				Silva M.A.P. 1458
FABACEAE						
<i>Anadenanthera colubrina</i> (Vell.) Brenan	tree				x	Silva M.A.P. 1498
<i>Bionia pedicellata</i> (Benth.) L.P.Queiroz	shrub	x				Silva M.A.P. 1433, Silva M.A.P. 1449
<i>Bowdichia virgilioides</i> Kunth.	tree	x			x	Silva M.A.P. 1469
<i>Calliandra depauperata</i> Benth.	shrub		x			Sousa J.R. 36
<i>Centrosema arenarium</i> Benth.	vine				x	Silva M.A.P. s/n
<i>Chamaecrista flexuosa</i> (L.) Greene	herb		x			Silva M.A.P. 1481
<i>Chamaecrista ramosa</i> var. <i>mollissima</i> (Benth.) H.S. Irwin and Barneby	subshrub			x		Gomes B.M. 460
<i>Clitoria</i> sp.1	subshrub	x			x	Silva M.A.P. 1475
<i>Copaifera langsdorffii</i> Desf.	tree	x	x			Cartaxo S.L. s/n, Silva M.A.P. s/n
<i>Crotalaria</i> aff. <i>goreensis</i> Guill. et Perro	subshrub				x	Silva M.A.P. s/n
<i>Dalbergia miscolobium</i> Benth.	tree		x			Gomes B.M. 470
<i>Dimorphandra gardneriana</i> Tul.	tree		x			Seixas E.N.C. s/n
<i>Dioclea grandiflora</i> Benth.	vine				x	Silva M.A.P. s/n
<i>Hymenaea eriogyne</i> Benth.	tree		x		x	Seixas E.N.C. s/n, Seixas E.N.C. s/n
<i>Leptolobium dasycarpum</i> Vogel	tree		x			Silva M.A.P. s/n
<i>Lonchocarpus</i> sp.1	tree	x				Cartaxo S.L. 5, Ferreira W.N. 9
<i>Parkia platycephala</i> Mart.	tree			x		Gomes B.M. 412, Silva M.A.P. 1401
<i>Periandra mediterranea</i> (Vell.) Taub.	subshrub				x	Silva M.A.P. 1446
<i>Plathymenia reticulata</i> Benth.	tree		x	x		Cartaxo S.L. s/n, Gomes B.M. 464
<i>Rhynchosia minima</i> (L.) DC.	vine		x			Oliveira J.G. s/n
<i>Senegalia langsdorffii</i> (Benth.) Seigler and Ebinger	tree		x			Silva M.A.P. s/n
<i>Senegalia riparia</i> (Kunth) Brith and Rose	tree		x			Silva M.A.P. 2633
<i>Senna rugosa</i> (G. Don) H.S. Irwin and Barneby	shrub	x			x	Silva M.A.P. 1503
<i>Senna splendida</i> (Vogel) H.S. Irwin and Barneby	shrub	x			x	Silva M.A.P. 1479
<i>Senna trachypus</i> (Benth.) H.S. Irwin and Barneby	shrub	x				Seixas E.N.C. s/n

TABLE 1. CONTINUED.

FAMILY/SPECIES	HABIT	PHYSIOGNOMY				VOUCHERS
		Cerr	Car	Cerd	Fes	
<i>Senna velutina</i> (Vogel) H.S. Irwin and Barneby	shrub	x	x			Silva M.A.P. s/n, Seixas E.N.C. s/n
<i>Stryphnodendron polyphyllum</i> Mart.	tree	x				Souza A.J.S. 5744
<i>Stryphnodendron rotundifolium</i> Mart.	tree	x				Silva M.A.P. 1501
<i>Stylosanthes capitata</i> Vogel	herb				x	Silva M.A.P. s/n
<i>Stylosanthes guianensis</i> (Aubl.) Sw.	subshrub	x				Silva M.A.P. 1404
<i>Swartzia flaemingii</i> Raddi	shrub	x				Alencar A.L. s/n
HYPERICACEAE						
<i>Vismia guianensis</i> (Aubl.) Choisy	tree				x	Silva M.A.P. 1454
KRAMERIACEAE						
<i>Krameria</i> cf. <i>argentea</i> Mart. ex Spreng.	herb		x			Silva M.A.P. s/n
LAMIACEAE						
<i>Aegiphila lhotskiana</i> Cham.	tree				x	Silva M.A.P. s/n
<i>Hyptis ampelophylla</i> Epling	herb	x				Gomes B.M. s/n
<i>Hyptis desertorum</i> Pohl ex Benth.	herb				x	Silva M.A.P. 1425
<i>Vitex flavens</i> Kunth	shrub	x				Silva M.A.P. 1505
LAURACEAE						
<i>Cassytha filiformis</i> L.	epiphytic	x				Gomes B.M. s/n
not identified 1	tree	x				Seixas E.N.C. s/n
not identified 2	tree				x	Seixas E.N.C. s/n
not identified 3	tree			x		Silva M.A.P. 1400
LOGANIACEAE						
<i>Strychnos gardneri</i> A. DC.	tree		x			Gomes B.M. 469, Silva M.A.P. 1528
LORANTHACEAE						
<i>Struthanthus</i> cf. <i>flexicaulis</i> Mart.	epiphytic	x				Cartaxo S.L. s/n
LYGODIACEAE						
<i>Lygodium venustum</i> Sw.	vine				x	Silva M.A.P. 1508
LYTHRACEAE						
<i>Lafoensia pacari</i> A. St.-Hil.	tree			x		Silva M.A.P. 1415
MALPIGHIACEAE						
<i>Banisteriopsis stellaris</i> (Griseb.) B. Gates	subshrub	x				Gomes B.M. 403, Silva M.A.P. 1482
<i>Banisteriopsis variabilis</i> B. Gates	vine		x			Gomes B.M. s/n, Seixas E.N.C. s/n
<i>Byrsonima coccolobifolia</i> Kunth	tree	x	x			Seixas E.N.C. s/n
<i>Byrsonima pachyphylla</i> A.Juss.	tree			x		Gomes B.M. 422, Silva M.A.P. 1526
<i>Byrsonima sericea</i> DC.	tree	x	x			Seixas E.N.C. s/n, Seixas E.N.C. s/n
<i>Stigmaphyllon paralias</i> A. Juss.	herb				x	Silva M.A.P. s/n
MALVACEAE						
<i>Pavonia</i> aff. <i>viscosa</i> A. St.-Hil.	vine		x			Oliveira, I.G. s/n
<i>Pavonia malacophylla</i> (Link and Otto) Garcke	subshrub	x				Gomes B.M. 406
<i>Triumfetta semitriloba</i> Jacq.	subshrub				x	Silva M.A.P. s/n
MELASTOMATACEAE						
<i>Miconia albicans</i> (Sw.) Triana	shrub	x				Silva M.A.P. s/n
<i>Miconia ligustroides</i> (DC.) Naudin	shrub				x	Gomes B.M. 453
MYRTACEAE						
<i>Eugenia punicifolia</i> (Kunth) DC.	tree	x				Gomes B.M. 480, Silva M.A.P. 1406
<i>Myrcia guianensis</i> (Aubl.) DC.	tree		x		x	Cartaxo S.L. s/n, Seixas E.N.C. s/n
<i>Myrcia splendens</i> (Sw.) DC.	tree			x	x	Alencar A.L. 100, Cartaxo S.L. s/n
<i>Myrcia tomentosa</i> (Aubl.) DC.	tree		x			Cartaxo S.L. s/n
<i>Myrciaria</i> cf. <i>strigipes</i> O. Berg.	tree				x	Figueiredo J.M. s/n
<i>Psidium myrsinites</i> DC.	tree	x				Gomes B.M. 479
<i>Psidium salutare</i> var. <i>pohlianum</i> (O. Berg) Landrum	tree	x				Gomes B.M. 478
<i>Psidium</i> sp. new. ind.	tree		x			Gomes B.M. 465, Seixas E.N.C. s/n
NYCTAGINACEAE						
<i>Guapira graciliflora</i> (Mart. ex Schmidt) Lundell	tree	x				Silva M.A.P. s/n
OCHNACEAE						
<i>Ouratea hexasperma</i> (A. St.-Hil.) Baill.	tree	x				Cartaxo S.L. s/n
<i>Ouratea spectabilis</i> (Mart.) Engl.	shrub				x	Alencar A.L. 88, Gomes B.M. 458
OLACACEAE						
<i>Ximenia americana</i> L.	tree	x	x			Gomes B.M. 467, Silva M.A.P. s/n

TABLE 1. CONTINUED.

FAMILY/SPECIES	HABIT	PHYSIOGNOMY				VOUCHERS
		Cerr	Car	Cerd	Fes	
ORCHIDACEAE						
<i>Catasetum</i> sp.1	epiphytic			x		Gomes B.M. 462
OXALIDACEAE						
<i>Oxalis frutescens</i> L.	herb				x	Silva M.A.P. 1478
PASSIFLORACEAE						
<i>Passiflora cincinnata</i> Mast.	vine		x			Gomes B.M.
<i>Passiflora silvestris</i> Vell.	vine		x			Seixas E.N.C. s/n
POLYGALACEAE						
<i>Bredemeyera brevifolia</i> (Benth.) Klotzsch ex A.W. Benn.	vine		x	x		Silva M.A.P. 1414, Seixas E.N.C. s/n
<i>Securidaca diversifolia</i> (L.) S.F. Blake	vine				x	Silva M.A.P. 1506
POACEAE						
<i>Aristida longifolia</i> Trind	herb	x				Costa I.R 294
<i>Eragrostis maypurensis</i> (Kunth) Steud	herb	x				Costa I.R 38
<i>Gymnospogon poliiasy</i> (Willd) F.Voes	herb	x				Costa I. R 32
<i>Trachypogon spicatus</i> (L.f) Kuntze	herb	x				Costa I. R. 25
PRIMULACEAE						
<i>Cybianthus detergens</i> Mart.	tree	x			x	Silva M.A.P. s/n, Cartaxo S.L. s/n
PROTEACEAE						
<i>Roupala montana</i> Aubl.	shrub		x			Silva M.A.P. 1533
RHAMNACEAE						
<i>Ziziphus joazeiro</i> Mart.	tree	x				Silva M.A.P. s/n
RUBIACEAE						
<i>Borreria brownii</i> (Rusby) Standl.	herb				x	Silva M.A.P. s/n
<i>Borreria densiflora</i> DC.	herb				x	Silva M.A.P. s/n
<i>Borreria verticillata</i> (L.) G. Mey	herb				x	Morais A.C.A. 166
<i>Chiococca alba</i> (L.) Hitchc.	shrub				x	Alencar A.L. 80
<i>Coccocypselum lanceolatum</i> (Ruiz and Pav.) Pers.	herb				x	Alencar A.L. 70
<i>Cordia myrciifolia</i> (K. Schum.) C.H. Perss. and Delprete	shrub			x	x	Gomes B.M. 423, Silva M.A.P. 1422
<i>Cordia rigida</i> (K. Schum.) Kuntze	shrub		x			Seixas E.N.C. s/n
<i>Coussarea hydrangeifolia</i> (Benth.) Müll. Arg.	tree				x	Silva M.A.P. 1419
<i>Declieuxia fruticosa</i> (Willd. ex Roem. and Schult.) Kuntze	herb	x				Morais A.C.A. 43
<i>Diodella apiculata</i> (Willd. ex Roem. and Schult.) Delprete	herb	x				Morais A.C.A. 60
<i>Fareamea nitida</i> Benth.	shrub			x		Alencar A.L. 64
<i>Guettarda virbunoides</i> Cham. and Schltdl.	shrub			x		Silva M.A.P. s/n
<i>Psychotria carthagenensis</i> Jacq.	shrub				x	Andrade A.O. 01
<i>Psychotria colorata</i> (Willd. ex Schult.) Müll. Arg.	subshrub				x	Morais A.C.A. 196
<i>Psychotria hoffmannseggiana</i> (Willd. ex Schult.) Müll.Arg.	subshrub				x	Seixas E.N.C. s/n
<i>Sabicea cinerea</i> Aubl.	vine				x	Santos M.A.F. s/n
<i>Tocoyena formosa</i> (Cham. and Schltdl.) K.Schum.	tree	x				Silva M.A.P. 1408
RUTACEAE						
<i>Zanthoxylum gardneri</i> Engl.	tree		x	x		Alencar A.L. 85, Seixas E.N.C. s/n
SALICACEAE						
<i>Casearia</i> aff. <i>rufescens</i> Cambess.	Tree		x			Figueiredo J.M. s/n, Seixas E.N.C. s/n
<i>Casearia grandiflora</i> Cambess.	tree	x			x	Silva M.A.P. 1425, Silva M.A.P. 146
<i>Casearia javitensis</i> Kunth	tree			x	x	Alencar A.L. 86, Gomes B.M. 455
SANTALACEAE						
<i>Phoradendron crassifolium</i> (Pohl ex DC.) Eichler	epiphytic			x		Gomes B.M. 459
<i>Phoradendron mucronatum</i> (DC.) Krug and Urb.	epiphytic		x			Seixas E.N.C. s/n
SAPINDACEAE						
<i>Matayba guianensis</i> Aubl.	tree		x	x		Alencar A.L. 91, Cartaxo S.L. s/n
<i>Magonia pubescens</i> A. St.-Hil.	tree	x				Silva M.A.P. 1522
<i>Serjania lethalis</i> A. St.-Hil.	vine				x	Silva M.A.P. 1468, Silva M.A.P. s/n
SAPOTACEAE						
<i>Chrysophyllum arenarium</i> Allemão	tree			x	x	Gomes B.M. 415, Silva M.A.P. 1530, Luz L.N. s/n
SIMAROUFACEAE						
<i>Simaba</i> sp.	shrub		x			Seixas E.N.C. s/n
<i>Simarouba amara</i> Aubl.	tree	x	x			Cartaxo S.L. s/n, Gomes B.M. 475

TABLE 1. CONTINUED.

FAMILY/SPECIES	HABIT	PHYSIOGNOMY				VOUCHERS
		Cerr	Car	Cerd	Fes	
SOLANACEAE						
<i>Solanum</i> sp.1	shrub	x				Silva M.A.P. s/n
<i>Solanum decompositifolium</i> Sendtn.	herb	x				Silva M.A.P. s/n
<i>Solanum paniculatum</i> L.	shrub				x	Silva M.A.P. 1486
<i>Solanum rhytidoandrum</i> Sendtn.	shrub	x			x	Seixas E.N.C. s/n, Silva M.A.P. 1418
<i>Solanum stipulaceum</i> Willd. ex Roem. and Schult.	subshrub				x	Silva M.A.P. 1519
STYRACACEAE						
<i>Styrax camporum</i> Pohl	tree	x			x	Silva M.A.P. s/n
TURNERACEAE						
<i>Turnera diffusa</i> Willd. ex Schult.	shrub	x				Cartaxo S.L. s/n
<i>Turnera melochioides</i> Cambess.	shrub	x			x	Silva M.A.P. 1427
VERBENACEAE						
<i>Lantana camara</i> L.	shrub		x		x	Seixas E.N.C. s/n, Oliveira J.G. s/n
<i>Lantana fucata</i> Lindl.	herb				x	Silva M.A.P. s/n
<i>Lippia</i> cf. <i>microphylla</i> Cham.	shrub		x			Seixas E.N.C. s/n
<i>Stachytarpheta polyura</i> Schauer	herb		x	x		Silva M.A.P. 1421
VITACEAE						
<i>Cissus erosa</i> Rich.	vine	x			x	Silva M.A.P. s/n, Seixas E.N.C. s/n
VOCHYSIACEAE						
<i>Qualea parviflora</i> Mart.	tree	x	x			Silva M.A.P. s/n, Silva M.A.P. s/n

ACKNOWLEDGMENTS: The authors would like to thank the Fundação de Apoio à Pesquisa de Goiás-FUNAPE for a grant to B. Gomes and E. N. Seixas. They are grateful to Mr. Damásio for field assistance and to the anonymous reviewers that gave important contributions to this article. They also thank to the plant collectors. This research was supported by the Brasil-Itália-PBBI Biodiversity Program. This article is one of the results of the Araripe Project 1-PBBI.

LITERATURE CITED

- Alencar, A.L., M.A.P. Silva and L.M. Barros. 2007. Florística e fitossociologia de uma área de cerrado na Chapada do Araripe - Crato-CE. *Revista Brasileira de Biociências* 5(2): 18-20.
- APG (Angiosperm Phylogeny Group) III. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Botanical Journal of Linnean Society* 161(20): 105-121.
- Araújo, G.M., A.R.T. Nascimento, S.F. Lopes, R.F. Rodrigues and J.A. Ratter. 2001. Structure and floristics of the arboreal component of a dystrophic Cerradão and comparison with other Cerradões in Central Brazil. *Edinburgh Journal of Botany* 68(3): 401-418.
- Araújo, F.S., F.R. Martins and G.J. Shepherd. 1999. Variações florísticas e estruturais do carrasco no Planalto do Ibiapaba, estado do Ceará. *Revista Brasileira de Biologia* 59(4): 663-678.
- Bridgewater, S., J.A. Ratter and J.F. Ribeiro. 2004. Biogeographic patterns, β -diversity and dominance in the cerrado biome of Brazil. *Biodiversity and Conservation* 13: 2295-2318.
- Castro, A.A.J.F. 1994. Comparação florística de espécies do cerrado. *Silvicultura* 15(5): 16-8.
- Castro, A.A.J.F. 1996. Cerrados do Brasil e do Nordeste: considerações sobre os fatores ecológicos atuantes, ocupação, conservação e fitodiversidade. *Revista Econômica do Nordeste* 27(2): 183-205.
- Castro, A.A.J.F. and F.R. Martins. 1999. Cerrados do Brasil e do Nordeste: caracterização, ocupação e considerações sobre a sua fitodiversidade. *Pesquisa em Foco* 7(9): 147-178.
- Castro, A.A.J.F., N.M.C.F. Castro, J.M. Costa, R.R.S. Farias, M.R.A. Mendes, R.S. Albino, J.S. Barros and M.E.A. Oliveira. 2007. Cerrados marginais do nordeste e ecótonos associados. *Revista Brasileira de Biociências* 5(1): 273-275.
- Costa, I. R. and F.S. Araújo. 2007. Organização comunitária de um enclave de cerrado *sensu stricto* no Bioma caatinga, chapada do Araripe, Barbalha, Ceará. *Acta Botanica Brasílica* 21(2): 281-291.
- Costa, I.R., F.S. Araújo and L.W. Lima-Verde. 2004. Flora e aspectos autoecológicos de um enclave de cerrado na chapada do Araripe, Nordeste do Brasil. *Acta Botanica Brasílica* 18: 759-770.
- Fernandes, A. 1990. *Temas fitogeográficos*. Fortaleza: Stylos Comunicações. 116 p.
- Filgueiras, T.S., P.E. Nogueira, A.L. Brochado and G.F. Guala II. 1994. Caminhamento: um método expedito para levantamentos florísticos qualitativos. *Cadernos de Geociências* 12: 39-43.
- Gardner, G. 1975. *Viagem ao interior do Brasil*. Rio de Janeiro: Editora Itatiaia. 246 p.
- IBAMA. 2004. *Plano de Manejo da Floresta Nacional do Araripe*. Brasília: Ibama. 318 p.
- IBGE. 1992. *Manual Técnico da Vegetação Brasileira*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.
- IBGE. 2004. *Mapa de Vegetação do Brasil*. Brasília: Ministério do Planejamento, Orçamento e Gestão. Instituto Brasileiro de Geografia e Estatística.
- IPECE. 2012. Perfil básico municipal. Electronic Database accessible at http://www.ipece.ce.gov.br/publicacoes/perfil_basico/perfil_basico-municipal-2011. Captured on 8 May 2012.
- IUCN. 2012. The IUCN Red List of Threatened Species. Electronic Database accessible at www.iucnredlist.org/apps/redlist/details/35372/0/full. Captured on 8 March, 2012.
- Mori, S.A., L.A.M. Silva, G. Lisboa and L. Coradin. 1985. *Manual de manejo do herbário fanerogâmico*. Ilhéus: Centro de Pesquisas do Cacau. 97 p.
- Moro, M.F., A.S.F. Castro and F.S. Araujo. 2011. Composição florística e estrutura de um fragmento de vegetação savânica sobre os tabuleiros pré-litorâneos na zona urbana de Fortaleza, Ceará. *Rodriguésia* 62: 407-423.
- Oliveira-Filho, A.T. and D.A. Carvalho. 1993. Florística e fisionomia da vegetação no extremo norte do litoral da Paraíba. *Revista Brasileira de Botânica* 16: 115-130.
- Ratter, J.A., S. Bridgewater and J.F. Ribeiro. 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 (1): 57-109.
- Ratter, J.A., S. Bridgewater and J.F. Ribeiro. 2006. Biodiversity patterns of woody vegetation of the Brazilian Cerrado; p.31-66 In R.T. Pennington, G.P. Lewis and J.A. Ratter. (eds). *Neotropical Savannas and Seasonally Dry Forests: Plant Diversity, Biogeography and Conservation*. Boca Raton: CRC Press-Taylor & Francis.
- Ribeiro, J.F. and B.M.T. Walter. 2008. As principais fitofisionomias do bioma Cerrado. In S.M. Sano, S.M.P. Almeida and J.F. Ribeiro (ed.). *Cerrado: ecologia e flora*. 1 ed. Brasília: Embrapa Cerrados/Embrapa Informação Tecnológica.
- Silva, J.M.C., M. Tabarelli and M.T. Fonseca. 2004. As áreas e ações prioritárias para a conservação da biodiversidade da caatinga; p. 349-374. In J.M.C. Silva, M. Tabarelli, M.T. Fonseca and L.V. Lins (orgs.). *Biodiversidade da Caatinga: áreas e ações prioritárias para a conservação*. Brasília: Ministério do Meio Ambiente/Universidade Federal de Pernambuco/Conservation International/Fundação Biodiversitas/EMBRAPA Semi-Árido.

RECEIVED: February 2012

ACCEPTED: June 2012

PUBLISHED ONLINE: August 2012

EDITORIAL RESPONSIBILITY: Pedro V. Eisenlohr