

Updated List of Endemic Seed Plant Species found on San Salvador Island, The Bahamas, with a Perspective on Historical and Current Significance

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Abstract - For the island of San Salvador in the Bahama Archipelago, we present an updated list of seed plants that are endemic to the Bahamas, applying currently accepted names. We also include species previously reported as Bahamian endemics that are no longer considered endemic due to distribution outside of the Bahamas. Comparison of recently published lists of endemic seed plants for the Bahamas with neglected earlier published studies and herbarium specimens extends the range of 7 taxa to San Salvador, increasing the number of Bahamian endemics on the island to 22 from the previously reported number of 15. We identify several Bahamian endemics previously reported to have a distribution including San Salvador whose presence on the island cannot be sufficiently documented. Our results amend the previously published list of Bahamian endemics in light of historical and current significance of the island's flora.

Introduction

The island of San Salvador, part of the Bahama Archipelago (comprising ~700 islands and islets plus the Turks and Caicos [15 islands and cays]) has been the location for considerable plant collecting, beginning with the arrival of Christopher Columbus in 1492 (Kingsbury 1991). Many of the plants that Columbus recorded and described in his log are still found on San Salvador Island (Kass 2009:2–3). Plant collections made on San Salvador Island (Watling's Island) in the 1890s through the present (Britton and Millspaugh 1920; Coker 1905; Correll and Correll 1982; Gillis 1969, 1970a, 1971; Hitchcock 1893; Howe and Wilson 1908; Kass 1991, 2005b, 2009; Kass et al. 1998; Smith 1982, 1993; Vincent and Hickey 2014; Vincent et al. 2002) were deposited in leading US herbaria, including Fairchild Tropical Garden (FTG), Field Museum of Natural History (F), Missouri Botanical Garden (MO), The New York Botanical Garden (NY); notable university herbaria, including Cornell University (BH), Harvard University (GH), Miami University (MU; located in Ohio), Michigan State University (MSC); and less publicized, smaller national and overseas herbaria, including Bahamas National Herbarium (BNH, which includes BNH-GRC, an annex herbarium of the BNH at the Gerace Research Centre on San Salvador Island), Elmira College (ECH), Florida State University (FSU), and Hartwick College (HHH).

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Britton and Millspaugh (1920) recognized over 14% (~132 species) endemism for flowering plants in *The Bahama Flora* (Taylor 1921). Such plants are considered native exclusively to The Bahamas and do not occur naturally elsewhere. William T. Gillis (1974) suggested that many of the species that Britton and Millspaugh listed as endemic were phantoms based on minor variants in the population, and that the geologic time span since the island flora had been established was too short for the amount of endemism previously calculated. He presented evidence as to why 28 of the endemics reported by Britton and Millspaugh (1920) should be reduced to synonymy within species present in neighboring countries (Cuba; Hispaniola; Florida, USA). He later estimated that about 30 species (of about 1000; 3%) of Bahama vascular plants were endemic (Gillis 1977a).

Correll and Correll (1982) reported 8.83% endemism (121 taxa) in the Bahama flora. They cautioned, however, that certain identified endemic plants may not be exclusively native to the Bahamas, based on taxonomic studies by Gillis and others.

The first and second editions of Smith's (1982, 1993) *Field Guide to the Vegetation of San Salvador Island* and his herbarium collections proved invaluable to ascertain the status of Bahamian endemic species currently growing on San Salvador Island. Both Gillis and Correll verified and annotated many of Smith's collections (Smith 1982:vii; Smith 1993:vii; herbarium specimens at HHH, BNH-GRC). Smith's voucher specimens are deposited at BNH-GRC, FTG, HHH, and NY.

Acevedo-Rodríguez and Strong (2012:vi) estimated that 9.4% (101 native) of the plants in the Bahama Archipelago are endemic taxa and reported 0% endemic genera. Those authors also reported 71% endemic taxa and 12.4% generic endemism for the West Indies as a whole (the Bahama Archipelago, the Greater and the Lesser Antilles), but did not include island distributions within the Bahama Archipelago (Acevedo-Rodríguez and Strong 2012:v). Their accompanying searchable online checklist for *Flora of the West Indies* (Acevedo-Rodríguez and Strong 2007) listed plant endemism for the Bahamas as 10.4%.

Initial studies by Freid et al. (2012) reported ~6.4% Bahamian endemism and more recent research (Freid et al. 2014) revised that figure to ~6% (89 species), which comes closer to the possibly more realistic 3–4% proposed by Gillis (1977a, b).

Comparing Smith's (1982, 1993) San Salvador checklists and herbarium specimens with the list of endemic plants and their distributions published by Freid et al. (2014:appendices 1, 2), we provide a revised account of endemic plant distributions for the Bahamian Archipelago. Specifically, we list endemic plants growing on San Salvador Island, including 7 additional endemic plant species (Appendix I) overlooked by Freid et al. (2014). We also list Bahamian endemics previously reported to have a distribution including San Salvador Island that we could not document with a voucher specimen (Table I). We discuss the importance of an accurate account of regional endemic species.

Field Site Description

San Salvador Island is a subtropical island located at the northeastern edge of the Bahama Archipelago, 24°N, 74°30'W, about 612 km east southeast of Miami, FL,

USA, and 346 km north of Cuba (see map in Landry et al. 2014:fig. 1). The island occupies almost the entire area of its marine platform and is surrounded by water exceeding 1000 m deep. The nearest islands of any size are Cat Island, 72 km to the west–northwest, and Rum Cay, 37 km to the southwest. The island is relatively small—20.3 km long in a north–south orientation and 11.3 km wide, with an area of ~157 km². Approximately 30% of the island is occupied by tidal creeks, hypersaline lakes and blue holes.

The climate of San Salvador is generally subtropical with summer high temperatures averaging 31 °C, and the coolest month, December, has a mean minimum of 17 °C (Smith 1993:3). Annual rainfall is seasonal and highly variable, varying from 102 cm to 178 cm with 2 rainy seasons, April–May and August–November, and it is common for the island to receive no precipitation for 2- or 3-month intervals (Smith 1993:3).

Vegetation

The current vegetation of San Salvador is best described as a scrubland-type with maximum height rarely exceeding 6 m for trees other than *Cocos nucifera* L. (Coconut Palm) and the invasive *Casuarina equisetifolia* L. (Australian Pine). The tallest native tree reported on the island, a *Quadrella cynophallophora* (L.) Hutch. (Syn. *Capparis cynophallophora* L.) (Black Willow), is about 13 m tall, and growing in a limestone pit where it is protected from prevailing winds. This tree grows at a considerable angle and only 3.5 m extends above the level of the pit. The island flora is diverse with ~564 species of vascular plants in 378 genera and 108 families (Smith 1993; T.P. Snyder et al., unpubl. data). There are an additional 26 species of bryophytes in 20 genera recognized on the island (Nash 1991). The bulk of the vascular plant flora is native or naturalized. Sixty-three species are found only as cultivated plants, and an additional 34 can be found as cultivated plants or as escaped or naturalized (Smith 1993).

Methods

We first compiled a list of plants identified as endemics by Correll and Correll (1982) for “Area No. 5” in their Bahamian Island distribution, which

Table I. Plants listed by Smith (1993) for San Salvador Island, and previously considered endemic to the Bahama flora, but whose presence on the island cannot be sufficiently documented by voucher specimens; Common names in parentheses from Smith (1993). (See Appendix I for current list of endemic plants of San Salvador Island.)

Family	Species
Boraginaceae, Borage Family	<i>Heliotropium diffusum</i> Britton (Low Heliotrope) <i>Heliotropium nanum</i> Northrop (Low Ashy Heliotrope)
Euphorbiaceae, Spurge Family	<i>Argythamnia lucayana</i> Millsp.
Malvaceae, Mallow Family	<i>Waltheria bahamensis</i> Britton (Common Waltheria)
Poaceae (Gramineae), Grass Family	<i>Eragrostis bahamensis</i> Hitchc. (Bahama Lovegrass)

comprised Conception Island, Rum Cay, and San Salvador Island, formerly Watling's Island (Correll and Correll 1982:1556). We compared the Corrells' Area 5 endemics with Smith's 1993 "Checklist of Vascular Plants of San Salvador", which restricted our list of plant endemics to San Salvador Island only. Smith (1993:24, chapter II) reported that his list is based on collections from the 1970s thru the 1980s and the list is supplemented by voucher collections made by the late D.S. Correll when he visited the island during the preparation of *Flora of the Bahama Archipelago*, "Collections were made of the native species ...". Most collections in the checklist for Smith's (1993) chapter II were "housed at Fairchild Tropical Garden herbarium [FTG] and the Hoystradt Herbarium of Hartwick College [HHH]" (Smith 1993:vii). Many of Smith's collections having HHH accession numbers are also deposited at the BNH-GRC (Kass et al. 1998). We personally examined all BNH-GRC and HHH herbarium specimens and communicated directly with herbarium curators when necessary, to confirm label data or specimen availability. As appropriate, we checked the virtual herbaria at F, NY, FTG, MO, and reviewed entries in Britton and Millspaugh's (1920) *The Bahama Flora* and in Coker (1905). We also checked plant names on The Plant List (<http://www.theplantlist.org/>), Tropicos (<http://www.tropicos.org/>), and International Plant Names Index (IPNI; <https://www.ipni.org/>). J. Solomon supplied details of specimens at MO, collected by W.T. Gillis.

We annotated Smith's list using the "Erratum" of Hodge et al. (1997), and additions to the Island's flora as reported in Clark (1998), Kass (2009:163), and Vincent et al. (2002). We then compared Gillis' (1974; 1976a, b) suggestions for eliminating 28 or more species identified as endemics for the Bahamas because they were found growing elsewhere than the Bahama Archipelago. In March 2013, we sent our list of potential endemics to Ethan Freid, who reviewed it and provided suggestions regarding endemic status in May 2013. We then updated our list and compared it with the endemic seed plants of the West Indies (comprising the Bahama Archipelago, the Greater Antilles, and the Lesser Antilles) as identified by Acevedo-Rodríguez and Strong (2012). Their *Catalogue of Seed Plants of the West Indies* provides distributions of the accepted taxa within the Greater Antilles and Lesser Antilles, but does not include island distributions within the Bahama Archipelago (Acevedo-Rodríguez and Strong 2012:v); genera they flagged with a single asterisk (*) are endemic, while those with a double asterisk (**) are nearly endemic to the West Indian flora.

We compared Smith's San Salvador Island checklists (Smith 1982:chapter II, 1993:chapter II) and many of his herbarium specimens with the list of "Endemic seed plants in the Bahamian Archipelago" (Freid et al. 2014:appendices 1, 2), including the more refined island distribution mapping (22 island groupings, San Salvador = 11; Fried et al. 2014:fig. 1a) initially established by Freid et al. (2003).

Our assignment of endemic plants of the Bahamas with San Salvador Island distributions is documented by Smith's checklists (1982, 1993) and herbarium collections (BNH-GRC, HHH), which we compared with Bahama Archipelago regional distributions in Acevedo-Rodríguez and Strong (2012:975–987); area distributions from Correll and Correll (1982; Area 5 includes San Salvador); W.T.

Gillis' Bahama Island distribution maps (Gillis 1970b), and file cards at MSC (W.T. Gillis card files, MSC archives); island grouping distributions reported by Freid et al. (2014:206 [figure 1a: San Salvador Island = island group 11], appendix 1 [San Salvador Island referenced as Dist. 11]); and personal observations for San Salvador Island (Kass 1986, 1991, 2005b, 2009; L.B. Kass research journals, 1982 to present; collections at BH, BNH, BNH-GRC; T.P. Snyder et al., unpubl. data). We amend here San Salvador Island endemic plant distributions omitted from these works.

We present our lists of endemic plants of the Bahamas found growing on San Salvador Island in Appendix I. Distributions for plant endemics that grow on this Island but were overlooked by Freid et al. (2014) are identified in Appendix I by an asterisk (*). Plants no longer considered endemic that are also found on San Salvador Island are listed in Appendix II. We compiled a list of plants that were previously reported as endemics for San Salvador Island (Correll and Correll 1982; Smith 1982, 1993) and are also considered endemic for the Bahama Archipelago (Freid et al. 2014), but for which we could not locate a voucher specimen for San Salvador Island, or which were vouchered and later annotated as a different species (Table I). We used current botanical plant names as given by Acevedo-Rodríguez and Strong (2012) or Freid et al. (2014), and we noted names applied previously or currently by others, i.e., The Plant List or Tropicos, when appropriate. Our Appendices follow the formatting of Freid et al. (2014) for ease of comparison with their list of endemics for the Bahama Archipelago. We note common names as used in Smith (1982, 1993). We number our appendices and table with Roman numerals to distinguish them from Arabic numerals used by Freid et al. (2014). Appendix II includes distributions as provided by Correll and Correll (1982) or Smith (1993), for San Salvador Island, because Freid et al. (2014:table 2) did not provide distributions for species they delisted as Bahama endemics.

We use herbarium codes as listed in *Index Herbariorum, Part I: The Herbaria of the World* (<http://sweetgum.nybg.org/ih/>).

Results

Endemic seed plant species recognized as growing on San Salvador Island

Herein we recognize 22 Bahamian endemic seed plant species or varieties that grow on San Salvador Island, which has an estimated 564 taxa of seed plants, giving a rate of 3.9% endemism for our insular flora (Acevedo-Rodríguez and Strong 2012, Freid et al. 2014:appendix 1). In Appendix I, we present taxa reported in Smith's (1982, 1993) "Checklist of Vascular Plants of San Salvador", and include taxa omitted by Freid et al. (2014) for which we found voucher specimens, and also note taxa reported by Correll and Correll (1982) with area distributions that include San Salvador Island. We offer current botanical names and note previous botanical names (synonyms) for each taxa. Appendix I also includes species long recognized as growing on San Salvador Island, and identified as endemic to the Bahamas by Britton and Millspaugh (1920) and by Correll and Correll (1982).

Fifteen of these endemic taxa were recently recognized as plants growing on San Salvador Island by Freid et al. (2014:206:island group 11, 209). We add 5 additional endemic plant species, *Agave braceana*, *Evolvulus bahamensis*, *Eleocharis bahamensis*, *Catesbaea foliosa*, and *Ernodea millspaughii*, previously omitted for San Salvador Island (Freid et al. 2014:grouping 11), and also 2 varieties, *Calliandra haematomma* var. *correllii*, and *Chamaecrista caribaea* var. *lucayana*, which were reported as Bahama endemics by Freid et al. (2014:appendix 2) within their notes for delisted endemics, but which were not listed within their species list of Bahamas endemic plants (Freid et al. 2014:appendix 1) (Appendix I: species marked with asterisk [*]). Acevedo-Rodríguez and Strong (2012) recognized these varieties as Bahamian endemics.

Seven plant species reported as endemic to the Bahama Archipelago (Freid et al. 2014:appendix 1) are listed here (Appendix I) for San Salvador Island as apparently, probable, or possible Bahamian endemic species: *Metastelma inaguense*, *Coccothrinax inaguensis*, *Agave braceana*, *Agave indagatorum*, *Wedelia bahamensis*, *Varronia bahamensis*, *Evolvulus bahamensis*.

Unvouchered endemic seed-plant species listed as growing on San Salvador Island

We could not verify 5 plant species listed by Smith (1993) as part of the San Salvador Island flora, *Heliotropium diffusum*, *Heliotropium nanum*, *Argythamnia lucayana*, *Waltheria bahamensis*, and *Eragrostis bahamensis*, which Freid et al. (2014) reported as endemic to the Bahama Archipelago. We list these taxa separately (Table I) with their family affiliations and common names to encourage further exploration and documentation of these species on the island.

Seed -plant species delisted as endemic to San Salvador Island

We identified 14 plant taxa previously accepted as endemic species for the Bahama Archipelago that grow on San Salvador Island, and which are now delisted (Appendix II), because they are found to be present in neighboring floras (Acevedo-Rodríguez and Strong 2012, Freid et al. 2014:appendix 2). We emphasize these here as an aid to researchers working on San Salvador Island and because distributions for delisted plants were not given by Freid et al. (2014:appendix 2). Our Appendix II presents currently delisted taxa (as identified by Freid et al. 2014), notes those reported in Smith's (1982, 1993) checklists, and offers current or previously applied botanical names (synonyms). This list includes species long recognized as growing on San Salvador Island, and identified as endemic to the Bahamas by Britton and Millspaugh (1920) and by Correll and Correll (1982), but that are now recognized outside The Bahamas (Acevedo-Rodríguez and Strong 2012, Freid et al. 2014). We also include citations for plants currently delisted as endemic (Freid et al. 2014), many of which were earlier nicknamed "phantoms" in Britton and Millspaugh's (1920) *The Bahama Flora* because they grew elsewhere than the Bahama Archipelago (Gillis 1974).

Discussion

Our detailed account of endemic seed plants for San Salvador Island, The Bahamas (Appendix I), resulted in modifying and extending the range and distribution for 7 endemic taxa that had been previously overlooked (Freid et al. 2014) for this island in the Bahama Archipelago. Our conclusions are based on examining plant lists and herbarium specimens for the Island of San Salvador, in the Bahama Archipelago, reviewing maps and distribution cards for plants of the Bahama flora, and over 30 years conducting research on San Salvador Island. Examining specimens at smaller and lesser-known herbaria proved invaluable to document distributions of endemic plants on San Salvador Island. Such specimens collected or cited previously can be found in herbaria other than those recently examined (Freid et al. 2014:205) to update records for endemic seed plants in the Bahama Archipelago.

Future studies may recognize some of the species listed as apparently probable or possible Bahamian endemic species (see results and Appendix I and Table I), or find them growing elsewhere than the Bahamas, thus reducing the number of endemics for the region and specifically for San Salvador Island. We are in the process of preparing an updated edition of Smith's 1993 checklist for the vegetation of San Salvador Island (T.P. Snyder et al., unpubl. data).

Records for plant collecting on San Salvador Island, The Bahamas

It is clear from Coker's (1905) and Britton and Millspaugh's (1920) reviews of collecting in the Bahamas, and specifically on San Salvador Island (Kass 2009:3), that their specimens and those collected by others were distributed to herbaria throughout the world and to US herbaria other than BNH, FTG, NY and MU.

Between 1969 and 1977, W.T. Gillis, R.H. Howard, and G.R. Proctor collected extensively on San Salvador Island and throughout the Bahamas (Gillis et al. 1973, Kass and Eshbaugh 1993). They estimated that about 40 percent of Britton and Millspaugh's (1920) published names were obsolete, and concluded that the flora might also include 100–125 additional species not previously recognized by Britton and Millspaugh (Beaman 1982). Of special concern were indigenous plants and their distributions. Voucher specimens were deposited at Arnold Arboretum Herbarium (A), Oakes Ames Herbarium (AMES), and GH (all now incorporated into GH; Carnegie Museum of Natural History (CM); FTG; MSC; and Natural History Museum of Jamaica (IJ). Examinations of specimens in more herbaria would help to document the distributions of endemic Bahamian taxa.

Smith's (1982, 1993) checklists of vascular plants of San Salvador Island did not specifically cite herbarium voucher specimens for each entry, or provide descriptions for new species, unlike an early checklist for the Islands of Andros and New Providence (Kass 2005a; Northrop 1902, 1910). Smith's lists were based on plants collected over a "10-year span" and housed at FTG and HHH; many were identified and verified by Gillis and the Corrells (Smith 1993:vii). Correll and Correll (1982) cited Smith's HHH collections for many San Salvador plant distributions. We therefore encourage exploration of the island for possible endemic seed plants reported by Smith (1982, 1993), for which we could not find voucher specimens (Table I).

We are confident that endemic plants verified by voucher specimens and listed in Appendix I provide an accurate assessment of the current status and distribution for the endemic island flora of San Salvador.

We found that using websites for distribution information can be unreliable. For example, island locality for Bahama Islands specimens is not fully available on Tropicos unless specimen and label images are provided. When island names are not provided, specific localities can only be obtained by requesting specimen-label details from curators. Moreover, we found website-database errors for herbarium specimens and labels, many of which are not accompanied by images. While searching for W.C. Coker's 1903 collections from San Salvador Island, we noted that other Coker Bahamian collections were inaccurately databased as 1904 (NY).

More-detailed island distributions for the Bahama Flora, including San Salvador Island

W.T. Gillis (1970b) compiled a set of maps for plants of the Bahamas (Kass and Eshbaugh 1993), which include distributions for 1210 species found throughout the Bahama Islands. Gillis' maps were based not only on specimens that he had collected, but also on specimens he examined at herbaria throughout the country and overseas. He recorded herbarium-specimen data on index cards (filed at MSC) and mapped plants to each major Bahamian island and cay rather than by areas. A few of his maps having San Salvador Island species distributions were published by others (Eshbaugh 1987, Eshbaugh and Wilson 1986, Kass et al. 2013), and his maps and herbarium record cards have proved useful for studies of San Salvador Island palms with relevance to endemic status (Cross et al. 2016). Gillis' unpublished documents corroborate many of the endemic plants listed by Smith (1982, 1993) for San Salvador Island, and for Area 5 localities reported by Correll and Correll (1982).

Why we care: Preserving plant biodiversity in the Bahamas and on San Salvador Island

An accurate account of the plant taxa on San Salvador Island, and especially of the island's endemic taxa, is an important step toward the goal of conserving plant biodiversity in the Bahamas (see also Eshbaugh and Wilson 1996).

David Campbell (1998:1) recounted that the Bahama Islands were "species-poor but rich in endemics." The importance of biodiversity on islands was emphasized by Tom Ranker (2014:207), former Botanical Society of America president, who highlighted the Convention on Biological Diversity (<http://www.cbd.int/idb/2014/>) and summarized its conclusions: "Islands and their surrounding nearshore marine areas constitute unique ecosystems often comprising many plant and animal species that are endemic—found nowhere else on Earth. ... these ecosystems are irreplaceable treasures". Ranker (2014:207) warned that these "treasures" are threatened by human-caused extinctions, with many islands experiencing some of the highest rates of species losses "due to direct or indirect human activity". Knowledge of the number of native species to an area, and more specifically determining the level of species endemism is requisite to stopping further species extinction, he stressed.

Indeed the introduction of alien organisms has posed major threats to native species in island countries nearer to or within the Bahamas (e.g., Cayman Islands [Kass 2013]; San Salvador Island [Coleman et al. 2013, Slusher et al. 2007]).

On San Salvador Island, invasive species have been shown to displace native species along shorelines (Coleman et al. 2013, Finkle and Elliott 2011, Kass et al. 2011), and in wetlands (Slusher et al. 2007). The government of the Bahamas is aware of these problems and has issued *The National Invasive Species Strategy for The Bahamas* (BEST 2003), in which 34 taxa known to be invasive alien plant species have been identified for The Bahamas. Accurate knowledge of endemic species and their distributions should aid in concentrating conservation efforts to preserve biodiversity for the Bahama Archipelago and specifically San Salvador. This knowledge should inspire studies, similar to those in Hawaii (Ranker 2014), to (1) prevent extinction of native and endemic species, (2) identify critically endangered plants, and (3) aid future research to save common, rare, threatened or endangered native Bahamian plant taxa.

Freid et al. (2014:204) rightly emphasized the insular system of the Bahama Archipelago as representing the “furthest north extreme of the Caribbean Island Biodiversity Hotspot” and its floral connection both with the US subtropical mainland and the Greater Antilles (Cuba, Hispaniola). A biodiversity hotspot is a biogeographic region that is both a significant reservoir of biodiversity and is threatened with destruction. The term biodiversity hotspot specifically refers to 25 biologically rich areas around the world that have lost at least 70 percent of their original habitat (Myers 1988).

Although, by definition, the Bahama Archipelago (including the Turks and Caicos Islands) is not part of the Caribbean Islands per se, thousands of islands belong to the broadly defined Caribbean Region (also called the West Indies). The Bahama Archipelago is included in the “outer limit” of the Caribbean biodiversity hotspot (<http://www.biodiversitya-z.org/content/biodiversity-hotspots>). To qualify as a biodiversity hotspot on the Myers et al. (2000) edition of the hotspot map, a region must meet 2 strict criteria: at least 0.5% or 1500 of its vascular plant species must be endemic, and it has to have lost at least 70% of its primary vegetation (Mittermier et al. 2004, 2011; see also Myers et al. 2000).

Acevedo-Rodríguez and Strong (2012:vii), estimated the total percent of endemism (taxa) exhibited by the seed plants of the West Indies (Caribbean Region: Bahama Archipelago, Greater and Lesser Antilles) to be nearly 71% (7446 endemic taxa, out of 10,470 indigenous taxa), though they reported no endemic families of seed plants for the region.

Gillis (1974:154) recounted, “The Bahama flora is essentially one which populated the islands during and since the Pleistocene.” Regarding endemics, he later posited that (a) the progenitors were from outside the region, and are probably missing now; (b) newly observed plants had probably been introduced by wind (especially hurricanes), rafting, birds, or inadvertently by humans; (c) endemism increases with the size of islands (banks), lessening of rainfall, and decreasing latitude; (d) San Salvador Island has a greater affinity with Hispaniola and its fauna

and flora than can be explained by proximity; and (e) each island (with the exception of Abaco and Grand Bahama) has a distinctive assemblage of plants, with a different dominant species on each island (Gillis 1977a).

Of the 1371 vascular plant species reported in 1982 for the Bahama flora, 28 were delisted as endemics because they occur in other regions, and 24 were delisted due to changes in taxonomy, bringing the endemic frequency to 6% (Freid et al. 2014). Our account of additional endemic plant species, subspecies, and varieties (Appendix I: taxa marked with an *) indicates that approximately two-thirds of the endemic seed plants for the Bahama Archipelago grow on San Salvador Island (representing 3.9% of the flora of the archipelago). Three species (*Agave indagatorum*, *Eleocharis bahamensis*, and *Evolvulus bahamensis*) that Freid et al. (2014:210, table 1) reported as “single-island grouping endemics”, are also found on San Salvador Island (Appendix I), thus revising and lowering the number of single-island grouping endemics to 27 taxa. We suggest these 3 species be considered with their listing of “two-island grouping endemics” (Freid et al. 2014:210, table 1), thus increasing that grouping from 19 to 22 taxa, and also modifying the number of “endemics restricted to a single-island cluster” (Freid et al. 2014:211, table 2), in the “Central and Southern Island clusters”. Also, if *Heliotropium diffusum* (Table I) is documented for San Salvador, it would be an addition to the “Southern Island Cluster”.

The highest number of endemic species was reported for the Bahamas “Southern Island Cluster” (59 species; Freid et al. 2014:206 [figure 1], 209). Endemic plant species now reported for San Salvador Island (Appendix I) would somewhat increase the number of endemics reported at the lower latitudes, with a proximity to Cuba and Hispaniola, and acting as a continuous source of plants for the Bahama Archipelago. This finding is consistent with the “phytogeographic hypothesis relating to the Bahama flora” reported by Gillis (1977a) and favored by Freid et al. (2014:210), relevant to “biogeography patterns” for the Bahama Archipelago.

We concur with the recommendations of Freid et al. (2014:212) to encourage and protect endemic species known to occur in 2 or fewer island groupings of the Bahamas and Turks and Caicos Islands. Future field studies to determine limits of species’ geographical areas might be aided by reviewing extant distribution maps, and employing the resources of the US Virtual Herbarium Project, which aims to database, image, and georeference specimens in all US herbaria to gain access to all biodiversity informatics (Barkworth and Murrell 2012).

Knowledge of endemic status may serve to assess areas for development and to protect species if they are being removed or their habitats disturbed or altered. The lists of endemic and delisted species reported by Freid et al. (2014:appendices 1, 2), along with the ones presented here (Appendices I, II; Table I) can help guide conservation efforts for the islands of the Bahamas.

The New York Botanical Garden (<https://www.nybg.org/plant-research-and-conservation/about/what-we-do/>; Boom 2016) is conducting a project to obtain a preliminary assessment of globally threatened plant species, to complement the International Union for Conservation of Nature (IUCN) Red List, for the Caribbean hotspot (<http://www.iucnredlist.org/about>). “The IUCN Species Program, ... has

been assessing the conservation status of species, subspecies, varieties, and even selected subpopulations on a global scale for the past 50 years in order to highlight taxa threatened with extinction, and therefore promote their conservation” (IUCN 2018a). Although not on our lists of endemics, 3 plant species that grow on San Salvador Island are reported to be on the updated IUCN Red List of Threatened Species (2018b): *Guaiacum sanctum* L. (Lignum Vitae, Zygophyllaceae), *Swietenia mahagoni* (L.) Jacq. (Mahogany, Meliaceae), and *Zanthoxylum flavum* Vahl (Yellow Wood, Rutaceae). The first 2 species are listed as endangered (EN) and the third is reported as vulnerable (V), “but needs updating”.

Freid et al. (2014:212), recommend that an IUCN Red List targeting plant endemics should be produced for the Bahamian Archipelago. Requisite criteria for each species are: population size and numbers, distribution area, and current and possible threats. Our evaluation of San Salvador Island endemic plants would be an asset for achieving this goal.

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Dedication

We dedicate this paper to the memories of Dr. Robert R. Smith and Dr. Donald Gerace; may their memories be a blessing.

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Appendix I. List of endemic seed plant species currently recognized on San Salvador Island, the Bahama Archipelago. This appendix of Bahamian endemic plant species found on San Salvador Island was originally compiled from the works of Correll and Correll (1982; abbreviated “C&C”), Smith (1993; abbreviated RRS), Smith (1982, 1st Edition), Acevedo-Rodríguez and Strong (2012; abbreviated “A-R&S”), and Freid et al. (2014; abbreviated “F,F-O&J”). As detailed in the methods, a comparison of these lists with Smith’s checklist and herbarium specimens, enabled us to evaluate and recognize the endemic species, as identified by Freid et al. (2014, with page sources), for plants we found on San Salvador Island; they are provided here as a ready reference for those working on the flora of San Salvador Island. Freid et al. (2014:206 [figure 1a], 209) reported 15 endemic species for San Salvador Island (island group #11), and here we add an additional 5 endemic species—*Agave braceana*, *Evolvulus bahamensis*, *Eleocharis bahamensis*, *Catesbaea foliosa*, and *Ernodea millspaughii*—to their count for a total of 20 Bahamian endemic plant taxa found on San Salvador Island, 3 of which are added to their “two-island grouping” endemics. We also list 2 additional varieties, *Calliandra haematomma* var. *correllii* and *Chamaecrista caribaea* var. *lucayana*, recognized by Freid et al. 2014, as endemic to the Bahamas, and which are also found on San Salvador. These 7 endemic taxa are marked with an asterisk (*), and are recognized here as occurring on San Salvador Island. Thus, 22 plants endemic to the Bahamas have a recognized distribution for the flora of San Salvador Island.

APOCYNACEAE (includes ASCLEPIADACEAE), Dogbane Family

Metastelma inaguense Vail, Bulletin of the New York Botanical Garden 4(13):142. 1906.

Syn.: *Cynanchum inaguense* (Vail) R.A. Howard & Dunbar. Rhodora 66:13. 1964.

Notes: RRS:46 listed the species as *Cynanchum inaguense*, and the earlier edition (Smith 1982:60) listed it as a synonym of *M. inaguense*. C&C:1156 treated the species as *C. inaguense*, “apparently endemic”. Earlier, Gillis (1974:159) published that “*C. inaguense* is identical with *C. caribaeum*”, and decided it was not endemic to the Bahamas (see also Gillis’ species distribution cards, MSC). Freid did not agree that *C. caribaeum* is the same as *C. inaguense* (E. Freid to L. Kass, email, 26 May 2013). Krings and Endress (2012:47) referencing C&C, reported the species as “endemic to Bahamas”. We follow F,F-O&J:217, who “consider that endemic species of *Cynanchum* L. belong to *Metastelma* R.Br.” We provide here the accurate reference for the protologue (the reference for *Cynanchum inaguense* was cited in error by F,F-O&J:217).

ARECACEAE (PALMAE), Palm Family

Coccothrinax inaguensis Read, Principes 10:30. 1966.

Notes: RRS:29, C&C:255, and A-R&S:73 listed or treated the species as *C. inaguensis*. F,F-O&J:218 considered this plant endemic to the Bahamas. Kass and Smith (Kass 1986), Kass (2009:130), Cross et al. (2016), and Kass and Reveal (unpubl. data), suggested the plants found on San Salvador Island are possible varietal forms of *C. argentata* (Jacq.) L.H. Bailey (Gentes Herbarium 4:223. 1939). Dransfield et al. (2008:228) advised that “a new treatment is much needed” for this genus. With regard to *C. inaguense*, Henderson et al. (1995:49) wrote, “It is also probable that *C. victorini* Leon, a poorly known Cuban species, is conspecific, in which case the latter name would have priority” (Memorias de la Sociedad Cubana Historia Natural “Felipe Poey” 13:139. 1939). Further study will be required to ascertain the validity of *C. inaguensis* Read as a species and a Bahamian endemic.

ASPARAGACEAE (AGAVACEAE), Asparagus Family

**Agave braceana* Trel., Memoirs of the National Academy of Sciences 11:40. 1913.

Notes: We add San Salvador Island to the distribution of *A. braceana* for Bahama endemics, based on the Checklist of RRS:30, 54; illustration, p. 78 and 2nd Edition book cover; a specimen at BNH-GRC (*R.R. Smith with Class 4702*, 28 November 1978, annotated R.R. Smith, June 1983), pollen collected from specimens in the BNH-GRC Herbarium on San Salvador Island (Snyder et al. 2007), and Kass' (2009:50) "Remarks" for *Agave* species found on San Salvador Island. C&C:310–311 listed the species for Area 5, which includes San Salvador Island. F,F-O&J:217 omitted the distribution for San Salvador Island (Distr. 11), and noted that Gillis (1976a) suggested merging Bahamian *A. braceana* and 4 other *Agave* species. Kass and Eshbaugh (1993) earlier reported that C&C did not recognize Gillis' (1976a) taxonomy, which would have reduced the number of endemics for the Bahamas. F,F-O&J:217 followed the taxonomy of A-R&S[:85], and recognized the Agaves as distinct species until additional research is available to clarify the species taxonomy. Following their account, and our knowledge of the island flora, we add *A. braceana* for San Salvador Island at this time. Furthermore, F,F-O&J:217, listed *A. bahamana* Trel. for San Salvador Island (Distr. 11), but we believe their distribution may be a typographical error. C&C:310 do not list *A. bahamana* in their Area 5 distributions (which includes San Salvador Island). Neither is *A. bahamana* on Smith's San Salvador Island plant checklist (RRS:30; Kass 2009:50), nor is there a herbarium specimen collected from San Salvador Island at HHH or elsewhere that we could locate. Gillis (1970b) did not map *A. bahamana* to San Salvador Island.

Agave indagatorum Trel., Memoirs of the National Academy of Sciences 11:42. 1913.

Notes: RRS:30 listed the species as *A. indagatorum*. C&C:313 listed Areas 4 and 5 distributions; the latter includes San Salvador Island, and they cite a specimen at NY (C&C:1558), which is the type specimen collected on Watlings' Island (now San Salvador Island), by Britton and Millspaugh (6155, 13 March 1907; NY 73215, 1 of 3 sheets; http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=518895, accessed 28 May 2018). A more recent specimen collected on San Salvador Island is deposited at FTG (*Lopez et al., SanSal#012*, Dec. 2016). F,F-O&J:218 listed the distribution for 2 island groupings (Distr. 8, Long Island; Distr. 11, San Salvador), yet their table 1 (F,F-O&J:210) listed the species as a single-island grouping endemic (8, Long Island). A second locality on San Salvador Island (Distr. 11) would more accurately reflect a 2-island grouping, and would modify this species for the "Central Island Cluster" and "Southern Island Cluster" (F,F-O&J:206, figure 1b). It is currently reported as restricted to a single "Central Island Cluster" (F,F-O&J:211, table 2). See also note for *A. braceana*, regarding recognizing distributions of *Agave* on San Salvador.

ASTERACEAE, Composite Family

Wedelia bahamensis (Britton) O.E. Schulz in Urban, Symbolae Antillanae, seu, Fundamenta florum Indiae Occidentalis 7(1):106. 1911.

Basionym: *Stemmodontia bahamensis* Britton, Bulletin of the New York Botanical Garden 4:126. 1905.

Notes: RRS:52 listed the name as *W. bahamensis* (Britt.) Schultz ex Urb., Bahama *Wedelia*. C&C:1548 used the same botanical name, along with the common name Rong Bush, and listed it as endemic with the caveat, "With further study our plant may possibly be found to be referable (sic) to *W. calycina* L. C. Rich. ... of Puerto Rico and the Lesser Antilles." The latter is not listed in C&C. Earlier, Gillis (1974:165) had published finding that

W. bahamensis “is the same as populations in Cuba and Hispaniola of *W. calycina*.” A specimen of *W. bahamensis* that Gillis collected in 1970 (Gillis 8778, MO 2592359), and mapped to San Salvador Island (W.T. Gillis 1970b), was determined (annotated) by John L. Strother (UC, 1991) as *Wedelia calycina* Rich. Two specimens in the San Salvador Island herbarium (BHN-GRC) collected by Smith in 1976 and R. deLanglade of Wittenberg University in 1983 were determined as *W. bahamensis*. Freid (email, E. Freid to L. Kass, 26 August 2013) does not accept *W. bahamensis* as a synonym of *W. calycina*. Until further studies have been made, we list *W. bahamensis* as a Bahama endemic, as per F,F-O&J:218 (Dist. 11), and which we previously reported for San Salvador Island (Snyder et al. 2007; Kass 2009:22, illustration in part from an FTG herbarium specimen of D.S. Correll 43799, Nov. 1974). And recent examination of 5 specimens at HHH, collected between 1971 and 1973 by Smith and students, 1 annotated by D.S. Correll confirming the species identification, *Smith 3141*, 1971, !D.S.C. 1980). We suggest a reexamination of the species, which may be found elsewhere than the Bahamas. Robinson and Funk (2012:140) reported the species as endemic to the Bahamas, and applied the name *W. bahamensis* (Britton) O.E. Schulz in Urban, as does IPNI (<http://www.ipni.org/ipni/idPlantNameSearch.do?id=244372-2>. Accessed 11 February 2015).

CAMPANULACEAE, Bluebell Family

Lobelia lucayana Britt. & Millsp., *Bahama Flora* (N.L. Britton and C.F. Millspaugh) 428. 1920.

Notes: RRS:51 listed this species with no common name. C&C:1435 applied the same name as RRS and reported the plant as endemic to the Bahamas with distributions for Areas 1, 2, 5 (includes San Salvador Island). A-R&S:205, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:219, Dist. 11 (San Salvador Island).

CONVOLVULACEAE, Morning Glory Family

**Evolvulus bahamensis* House, Bulletin of the Torrey Botanical Club 35:89. 1908.

Notes: Smith (1982:61) listed the plant as *E. arbuscula* Poir. in Lam., with the synonym *E. bahamensis* House, Bahama Evolvulus. We believe that Smith (1982) listed as a synonym, House’s (1908) new species mentioned in the 1920 *Bahama Flora*, based on the specimen Smith collected in 1971 and identified as *E. bahamensis*, then annotated in 1979, and listed as *E. arbuscular* (R. R. Smith 3038, 4 Dec. 1971, annotated Nov 1979; BNH-GRC/HHH accession #16551); a name used by Gillis (1974:160), and mapped to San Salvador (Gillis 1970b). RRS:47 later listed the name *E. arbuscula*, Bahama Evolvulus, omitting the synonym. C&C:1169–1170 listed *E. bahamensis* as a synonym of *E. arbuscula*; Area 5 (includes San Salvador Island) among Bahama distributions. C&C:1170 noted, “Van Ooststroom maintained *E. bahamensis* separate from *E. arbuscula*. ... I find insufficient differences to recognize the Bahamian plants as distinct.” Earlier, Gillis (1974:161) had rejected the 3 species of *Evolvulus* recognized by Ooststroom (1934), and suggested merging all “Bahama populations of woody *Evolvulus* as *E. arbusculus* (*sic*) Poir. in Lam.” F,F-O&J:220 reported that C&C merged this species with *E. arbuscula*, the Greater Antillean endemic, but recent work, i.e., A-R&S[:237], considered *E. bahamensis* “to be a good [distinct] species endemic to the Bahamas.” A-R&S:237 referenced C&C for the species *E. bahamensis*, endemic to the Bahamas, and IPNI for the basionym; however, C&C:1169 listed the name only as a synonym of the non-endemic *E. arbuscula*. The Plant List reports *E. bahamensis* as an unresolved name (<http://www.theplantlist.org/tpl/record/tro-8500212>. Accessed 4 March 2013). We add this species to the endemic flora for the island based on Smith’s checklists for San Salvador Island (Smith’s specimen at BNH-GRC); mention by

House (1908) of collections on Watling's Island (*Britton & Millspaugh 6082*, 1907), which he cited in his description for the new species, along with the type specimen (*Nash & Taylor 1176*; NY 111071) collected on Inagua; and the name as accepted by van Ooststroom (1934) (Tropicos.org. Missouri Botanical Garden; <http://www.tropicos.org/Name/8500212>. Accessed 4 March 2013). We suggest the plant be added to the “two-island grouping endemics” (1 + 11) in the “Southern Island Cluster” instead of the “single-island grouping endemics”, as currently reported by F,F-O&J (210:table 1, 211:table 2, 220:island group 1).

CORDIACEAE (previously included in Boraginaceae, Borage Family⁺)

Varronia bahamensis (Urb.) Millsp., Publication. Field Columbian Museum Botanical Series 2(7):310. 1909.

Basionym: *Cordia bahamensis* Urb., Symbolae Antillanae, seu, Fundamenta florae Indiae Occidentalis 1(3):392. 1899.

Notes: RRS:47 listed the plant as *Cordia bahamensis*, with the common name Cocobey, and the earlier edition (Smith 1982:62) listed it as a synonym of *Varronia bahamensis*. C&C:1196 listed the species as *C. bahamensis*, with reported distributions in Florida and elsewhere than the Bahamas. F,F-O&J:219 considered the reported distributions in Florida and elsewhere as possibly referring to “naturalized or cultivated” plants, and included a distribution for San Salvador Island. Britton and Millspaugh (1920:358) listed the species as *V. bahamensis* with distributions for the Bahamas, including Watling's Island (now San Salvador Island), and for Cuban Cays: Anegada. Feuillet (2012:170), referencing C&C, reported the species as *V. bahamensis*, endemic to the Bahamas. Specimens at NY collected by the NYBG Exploration of the Bahamas are annotated above the label in Britton's handwriting as “*Varronia bahamensis* (Urban) Millsp” (e.g., *Britton & Millspaugh 6058*, *Cordia bahamensis* Urban, Watling's Island; NY 1360734; annotated by M.A. Vincent [August 2008], *Cordia bahamensis* Urban). Until the origin of non-Bahamian populations is resolved, we list the plant as *Varronia bahamensis* (Urb.) Millsp., a Bahamian endemic with a distribution on San Salvador Island.

⁺The family was revised by Luebert et al. 2016.

CYPERACEAE, Sedge Family

**Eleocharis bahamensis* Boeckeler, Beiträge zur Kenntnis der Cyperaceen 2:11. 1890.

Notes: RRS:28 listed this species with no common name. C&C:226 reported the plant as endemic to the Bahamas with distributions for Areas 1, 4–9 (Area 5 includes San Salvador Island). A-R&S:272, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:210(table 1), listed the plant with a restricted “single-island grouping endemic”, but omitted San Salvador Island in their distribution (p. 220). Based on Smith's checklists for San Salvador Island, herbarium specimens at BNH-GRC (e.g., *R.R. Smith with class 5015*, 5 December 1978, HHH accession #18703), W.T. Gillis' (1970b) distribution maps, the Corrells' distributions, and personal records by L.B. Kass, we add this species to the endemic flora for the island, and suggest the plant be added to the “two-island grouping endemics” (1 + 11) in the “Southern Island Cluster” instead of the “single-island grouping endemics”, as currently reported by F,F-O&J:210 (table 1), 211 (table 2).

EUPHORBIACEAE, Spurge Family

Croton brittonii Acev.-Rodr., Smithsonian Contributions to Botany 98:324. 2012.

Notes: Smith (1982:49) and RRS:39 listed the plant as *Croton humilis* L., Pepper Bush. C&C:790 also listed it as *C. humilis*, with the synonym *C. bahamensis* Millsp., and distribution encompassing Areas 3, 5 (includes San Salvador Island), 7, and 8, and Florida. C&C

did not consider the plant endemic to the Bahamas. D.S. Correll annotated NY specimens of *C. bahamensis* Millsp. (i.e., *Wilson* 7330, 27, 28 Nov. 1907, NY 1387476, collected on Watling's Island [San Salvador Island], http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=1656142. Accessed 28 May 2018; *Britton & Millspaugh* 5574, NY 83321; http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=156661. Accessed 28 May 2018) as *C. humilis*. Britton and Millspaugh (1920:224) listed *C. bahamensis* as endemic for the Bahamas, and only noted *C. humilis* as a synonym reported by Hitchcock and others. F,F-O&J:220 listed the new combination (binomial name), *C. brittonii* Acev.-Rodr. (published by A-R&S:324 as a *nom. nov.* for the illegitimate name *C. bahamensis* Millsp.), and included San Salvador Island (Distr. 11) in their species distributions. We list it as apparently endemic.

Euphorbia cayensis Millsp., *Torrey* 4:172. 1904.

Notes: RRS:39 listed this species with no common name. C&C:806 reported the plant as endemic to the Bahamas, common name Bahama Spurge, and included Area 5 (includes San Salvador Island) in their distributions. A-R&S:331, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:220 (Distr. 11; San Salvador Island).

Euphorbia gymnonota Urb., *Symbolae Antillanae, seu, Fundamenta florae Indiae Occidentalis* 5:396. 1908.

Notes: RRS:39 listed this species with the common name, Milk Plant. C&C:807–809 reported the plant as endemic to the Bahamas, no common name, and included Area 5 (includes San Salvador Island) in their distributions. A-R&S:332, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:220 (Distr. 11; San Salvador Island).

Euphorbia lecheoides Millsp., *Publication. Field Columbian Museum Botanical Series* 2(3):163. 1906.

Notes: RRS:39 listed this species with the common name Pin-weed Spurge. C&C:812–813 reported the plant as endemic to the Bahamas, same common name as RRS, and included Area 5 (includes San Salvador Island) in their distributions. A-R&S:334, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:220 (Distr. 11; San Salvador Island).

Euphorbia vaginulata Griseb., *Flora of the British West Indian Islands* 52. 1859.

Notes: RRS:39 listed this species with the common name Sheathed Spurge. C&C:817 reported the plant as endemic to the Bahamas, no common name, and included Area 5 (includes San Salvador Island) with their distributions. A-R&S:337, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:220 (Distr. 11; San Salvador Island).

FABACEAE (LEGUMINOSAE–Subfamily Mimosoideae), Pea Family

**Calliandra haematomma* (Bertero ex DC.) Benth. var. *correllii* Barneby, *Memoirs of the New York Botanical Garden* 74(3):142. 1998.

Notes: RRS:35 listed the plant as *C. haematomma*, with the common name Red Calliandra (specimen at HHH; T. Snyder and K. Snyder also collected pollen from a plant on San Salvador Island [Snyder et al. 2007:table 1]). C&C:610 listed the same names as RRS and reported it as “apparently endemic”, with distributions that included Area 5 (includes San Salvador Island). F,F-O&J:227(appendix 2) delisted “*C. haematomma* (DC.) Benth.” as a Bahama endemic (see Appendix II), but reported that “*C. haematomma* var. *correllii* Barneby is the only taxon of this species endemic to the Bahamas.” Acevedo-Rodríguez in A-R&S:405 listed the new variety as endemic to the Bahamas, referencing Barneby (1998).

The plant was collected by *W.C. Coker* (484, 12 July 1903; NY 01491670), as “*Calliandra haematomma* (DC.) Benth.” on Watling Island (now San Salvador Island) during the expedition to the Bahamas, sponsored by the Geographical Society of Baltimore (Coker 1905, Shattuck 1905); this and other herbarium specimens for this plant at NY were annotated by Barneby as “var. *correllii*” (http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=1818690. Accessed 21 May 2018; *Gillis* 5260, San Salvador Island 19 March 1963, NY 01492999, http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=1073925. Accessed 21 May 2018). Kass (2009:106) unintentionally listed the name *C. haematomma* for a description of *C. haematomma* var. *correllii* Barneby, which Rathcke and Kass (2003a) had studied earlier on San Salvador Island. We add here a San Salvador Island distribution for the Bahama endemic (variety) *C. haematomma* var. *correllii*.

FABACEAE (LEGUMINOSAE-Subfamily Caesalpinioideae), Pea Family

**Chamaecrista caribaea* (North.) Britton var. *lucayana* (Britton) H.S. Irwin & Barneby, *Memoirs of the New York Botanical Garden* 35(2):682. 1982.

Basionym: *Cassia lucayana* Britton, *Bulletin of the New York Botanical Garden* 4:138. 1906.

Notes: RRS:36 listed the plant as *Cassia lucayana*, no common name. C&C:621 listed it as RRS and reported it as endemic to the Bahamas, with distributions including Area 5 (includes San Salvador Island). F,F-O&J:227 (appendix 2) delisted “*C. lucayana*” as a Bahama endemic (see Appendix II), and reported that “this species is considered part of the *Chamaecrista caribaea* (North.) Britton complex, a taxonomic group that has three varieties”, of which “*Chamaecrista caribaea* var. *lucayana* (Britton) Irwin & Barneby” is considered endemic to the Bahamas. Lewis and Acevedo-Rodríguez (2012:413), referencing Irwin and Barneby (1982), listed the new variety as endemic to the Bahamas. We add here a San Salvador Island distribution for the Bahama endemic (variety) *C. caribaea* var. *lucayana*.

FABACEAE (LEGUMINOSAE-Subfamily Faboideae), Pea Family

Galactia bahamensis Urb., *Symbolae Antillanae, seu, Fundamenta florae Indiae Occidentalis* 2:331. 1900.

Notes: RRS:37 listed this species with the common name, Bahama Milk-pea. C&C:645 listed the same names as RRS, and reported it as endemic, with distributions including Area 5 (includes San Salvador Island). T. Snyder and K. Snyder collected pollen from a plant on San Salvador Island (Snyder et al. 2007:table 1); and Smith identified a specimen, collected on San Salvador Island by his students, now deposited at BNH-GRC (*Andrew et al. s.n.* Dec. 1971, det. R.R. Smith, BNH-GRC, HHH accession #17667). Lewis and Acevedo-Rodríguez (2012:430), referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:221 (Distr. 11; San Salvador Island).

MALVACEAE, Mallow Family

Pavonia bahamensis Hitchc., *Report (Annual) Missouri Botanical Garden* 4:63. 1893.

Notes: RRS:42 listed this species with the common name Bahama Swamp Bush. C&C:939 listed the same names as RRS and reported it as endemic, with distributions that included Area 5 (includes San Salvador Island). Beginning in December 1994, B. Rathcke and colleagues studied the reproductive biology of *Pavonia* on San Salvador Island (Rathcke 1998, 2000; Rathcke et al. 1996). T. Snyder and K. Snyder collected pollen from a specimen in the BNH-GRC Herbarium, and from a plant on San Salvador Island (Snyder et al. 2007:table 1). Dorr (2012:516), referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:221 (Distr. 11; San Salvador Island).

RUBIACEAE, Madder Family

**Catesbaea foliosa* Millsp., Publication. Field Columbian Museum Botanical Series 2(7):312. 1909.

Notes: RRS:50 listed this species with the common name Leafy Catesbaea. C&C:1380–1381 recognized this species as “endemic”, with distributions that included Area 5 (includes San Salvador Island), but cautioned that it may prove to be only varietally different from *C. parviflora*. Gillis’ (1974:162) earlier examination of all type specimens showed extreme variability. He suggested the name *C. parviflora* for the 5 species represented by types, and mapped *C. parviflora* to San Salvador Island (Gillis 1970b). Smith’s specimen at BNH-GRC [*R.R. Smith 3051a*, 4 Dec. 1971, spineless] was initially determined as *C. foliosa*, and later annotated as *C. parvifolia* (November 1979), possibly because of Gillis’ suggested merging of the species. *C. parviflora* is not endemic and Freid does not consider it a synonym of *C. foliosa* (email, E. Freid to L. Kass, 26 May 2013). F,F-O&J:222 listed *C. foliosa* as endemic to the Bahamas. A-R&S:803 listed “***C. foliosa* Millsp.” preceded by 2 asterisks, meaning they believe the genus is “nearly endemic” to the region (p. v), and reported it as “endemic to the Bahamas”. Based on Smith’s herbarium specimen, which is spineless (a character of this species), personal observations (L.B. Kass field notes, 14 June 2001, trail to Osprey pond), and spineless specimens at MU, collected on San Salvador Island (*Eshbaugh & Wilson 85-003*, 12 June 1985; *Vincent et al. 8959*, 22 May 2000), we consider the species as endemic for the Bahamas, with a distribution on San Salvador Island.

Erithalis diffusa Correll, Journal of the Arnold Arboretum 58(1):47. 1977.

Notes: RRS:50 listed this species with the common name, Low Black Torch (p. 65, under illustration). C&C:1386 listed the same botanical name as RRS and reported it as endemic, with distributions that included Area 5 (includes San Salvador Island). A-R&S:808, referencing C&C, reported the plant as endemic to the Bahamas. Kass (2009:74) used the common name Low Black Torch. F,F-O&J:221 included San Salvador Island in their distributions (Distr. 11), but mistyped its 2-island grouping distribution in table 1 (p. 210). We suggest amending this species distribution-listing for their “two-island grouping endemics,” from Distributions “6, 1” to 6, 11 (Crooked and Acklins, San Salvador; F,F-O&J:206).

**Ernodea millspaughii* Britton, Bulletin of the Torrey Botanical Club 35:207. 1908.

Notes: RRS:50 listed this species with the common name, Millspaugh’s Ernodea. C&C:1391–1393 listed the same botanical name as Smith, and reported it as endemic, with distributions that included Area 5 (includes San Salvador Island). A San Salvador Island specimen was annotated as *E. millspaughii* by D.S. Correll (*Daggett 6-10*, Feb. 1973, det. D. S. Correll 1979, BNH-GRC, HHH accession #18931). A-R&S:809, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:223 omitted San Salvador Island in their distributions. We add San Salvador Island to the distribution for Bahama endemics, based on the San Salvador Island Checklist of RRS:50, and specimens at BNH-GRC.

SAPINDACEAE, Soapberry Family

Thouinia discolor Griseb., Flora of the British West Indian Islands 127. 1859.

Notes: RRS:41 listed this species with the common names, Three Fingers, Naked Wood. C&C:886 listed additional common names, Quicksilver-bush, Hard Bark, and reported it as endemic, with distributions that included Area 5 (includes San Salvador Island). Rathcke and Kass (2003b) studied the reproductive biology of this Bahamian endemic on San Salvador Island. A-R&S:880, referencing C&C, reported the plant as endemic to the Bahamas. F,F-O&J:221 (Distr. 11; San Salvador Island).

Appendix II. Seed plant species delisted as endemic to San Salvador Island in the Bahama Archipelago. This appendix includes 14 plant species found on San Salvador Island that were previously accepted as Bahamian endemics for the Bahama Archipelago by Correll and Correll (1982; abbreviated “C&C”), Smith (1993; abbreviated RRS), Smith (1982, 1st Edition), or Acevedo-Rodríguez and Strong (2012; abbreviated “A-R&S”), and recently delisted by Freid et al. (2014; abbreviated “F,F-O&J”). The taxa were delisted because the latter did “not consider them as part of the endemic flora of the archipelago” because they are found elsewhere than the Bahamas. As described in our methods, a comparison of these lists with Smith’s checklist and herbarium specimens, enabled us to evaluate and recognize the delisted species as identified by Freid et al. (2014: with page sources), for plants we found on San Salvador Island, and provided here as a ready reference for those working on the flora of San Salvador Island. We also provide distribution areas as reported by Correll and Correll (1982:1554 [map], 1556–1557).

APOCYNACEAE (includes ASCLEPIADACEAE), Milkweed Family

Metastelma bahamense Griseb., *Catalogus Plantarum Cubensium* 174. 1866.

Notes: RRS:46 and Smith (1980:60) listed the species as *Cynanchum bahamensis* (Griseb.) Gillis. C&C:1154 (illustration “i” p. 1155) also accepted Gillis’ (1974:158) new combination for the synonym *Metastelma bahamensis* Griseb. C&C did not consider the plant endemic to the Bahamas; reported a distribution for Cuba, but not for Florida (as mentioned by Gillis [1974]), and listed distributions for the Bahama Archipelago; Areas 3–11 (Area 5 includes San Salvador Island). Krings and Endress (2012:46) accepted the name *M. bahamense* Griseb. as endemic to the Bahamas, yet note that C&C report a distribution for Cuba. Gillis (1974:158) suggested that Britton and Millspaugh’s *M. bahamensis* may be variants of *M. northropiae* Schltr., and *C. northropiae* (Schltr.) Alain (type *N&N* 410 [*M. bahamensis* sensu Northr.]), and that these taxa should be united under the new combination *C. bahamense* (Griseb.) Gillis. Krings and Endress (2012:46, 47) should have listed the synonym “*M. bahamensis* sensu Northr. = *M. northropiae* Schltr. in Urban”, and not as “*M. bahamensis* Northr. = *M. northropiae* Schltr.”, so as not to confuse these species with *M. bahamense* Griseb. (email, M. Strong to L. Kass, 3 March 2015). C&C:1156 did not unite the species; instead they separately listed *C. northropiae* with distributions for the Bahamas, Florida and Cuba. Krings and Endress (2012:46, 47) recognized both taxa (*M. bahamense* and *M. northropia*) as distinct species. They separately listed *M. northropiae* with distributions “Native to the Bahamas, Cuba, and the United States (FL)”. F,F-O&J:217 accepted “that endemic species of *Cynanchum* L. belong to *Metastelma* R.Br.”. F,F-O&J:224 delisted the species based on a distribution outside the Bahama Archipelago, and also noted that “*M. bahamense* is morphologically similar to *M. northropiae* (see above), and additional research is needed to determine if these species should be kept separately.” Nevertheless, both species have been reported for San Salvador Island (as *C. bahamensis* and *C. northropiae*), and are found elsewhere than the Bahamas. Whether the species are kept separately or combined in the future, we concur that *M. bahamense*, previously reported from San Salvador Island as syn. *C. bahamensis* should *not* be considered a Bahama endemic.

CACTACEAE, Cactus Family

Opuntia bahamana Britton & Rose, *Cactaceae* 1:203. 1919.

Notes: RRS:43 listed this species for San Salvador Island, common name Bahama Prickly-pear. C&C likewise listed the species, and recorded it as endemic to the Bahamas, with

distributions for Areas 1, 3, 5 (includes San Salvador Island), 7. AR&S:200 accepted the name *O. stricta* (Haw). Haw for the synonyms *O. bahamana* Britton & Rose, and *Consolea bahamana* (Britton & Rose) A. Berger; distributions “Native to the Bahamas, Cuba, United States, and eastern Mexico”. F,F-O&J:225 delisted the species noting it is found elsewhere than the Bahama Archipelago.

Opuntia nashii Britton., Bulletin of the New York Botanical Garden 3:446, 1905.

Notes: RRS:43 listed this species from San Salvador Island, common name, Nash’s Prickly Pear. C&C:1014–1016 likewise recognized this species and listed it as endemic to the Bahamas; Areas 1–3, 5 (includes San Salvador Island), 6, 8, 9. A-R&S:194, 200, reported the accepted name as *Consolea nashii* (Britton) A. Berger. F,F-O&J:225 reported that species of *Opuntia* were transferred to *Consolea* Lemaire (Cactaceae) and delisted *O. nashii* Britt. because it also occurs in Cuba (Syn. *C. nashii* subsp. *gibarense* Areces). F,F-O&J further noted that *Consolea nashii* subsp. *nashii* is a Bahamian endemic, citing Areces-Mallea (2001[:105]) (not listed in A-R&S). Guiggi (2007:23–24) applied the new subspecies combination *Consolea macracantha* subsp. *nashii* (Britton) Guiggi for *Opuntia nashii* subsp. *nashii* (= *Consolea nashii* subsp. *nashi*). Guiggi cited specimens at NY collected in the Bahamas and on Navassa Island for his new combination. If Guiggi’s combination is accepted, it would not be considered a Bahama endemic because Navassa Island, off the coast of Haiti and south of Cuba, is outside the Bahama Archipelago. By extension, *Consolea nashii* subsp. *nashii* would not be a Bahamian endemic.

EHRETIACEAE (previously included in Boraginaceae⁺, Borage Family)

Rocheftoria bahamensis Britton, Bulletin of the New York Botanical Garden 5:317. 1909.

Syn.: *Rocheftoria spinosa* (Jacq) Urb. ssp. *bahamensis* (Britton) Freid & Jestrow. Bot. Rev. 80:225. 2014.

Notes: RRS:48 listed this species as did C&C:1212, who recognized it as endemic to the Bahamas, with distribution in Areas 3, 5 (includes San Salvador Island). F,F-O&J:225 delisted the species and treated the Bahamian plants as a subspecies of *R. spinosa*—citing the type specimen from Watling’s Island (now San Salvador Island) collected by *Britton and Millspaugh* (6167, 13 March 1907; NY 111152). Smith’s more recent San Salvador collection is at NY (*Smith 5456*, 30 Nov 1979, label ID *Rocheftoria bahamensis* Britt.; NY 1352864), listed on NYBG virtual herbarium as *Rocheftoria spinosa*, http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=1579221). This species is currently treated as *R. bahamensis* and cited as also occurring in Cuba. It is not related to South American *R. spinosa*, previously treated as occurring in the West Indies by authors. See Irimia and Gottschling (2016), and Irimia et al. (2015).

⁺The family was revised by Luebert et al. 2016

FABACEAE (LEGUMINOSAE – Subfamily Mimosoideae), Pea Family

Acacia acuífera Benth., London Journal of Botany 1:496. 1842.

Notes: RRS:35 listed this species for San Salvador Island, common names Cassip, Pork and Doughboy. C&C:1212 likewise recognized this species and listed it as endemic to the Bahamas; Areas 1–3, 5 (includes San Salvador Island), 7, 8, 10. Acevedo-Rodríguez (2012:393, 466) accepted the name *Vachelia acuífera* (Benth.) Seigler & Ebinger (Leguminosae [Fabaceae]–Mimosoideae) for the synonym *A. acuífera* Benth.; reporting it as “Endemic to the West Indies, Native to the Bahamas, and Hispaniola.” F,F-O&J:226 delisted this species, noting that it was found elsewhere than the Bahama Archipelago.

Calliandra haematomma (Bertero ex DC.) Benth., London Journal of Botany 3:103. 1844. Syn. *Calliandra haematomma* var. *correllii* Barneby, Memoirs of the New York Botanical Garden 74(3):142. 1998.

Notes: RRS:35 listed this species with the common name, Red Calliandra. F,F-O&J:227 delisted the species and reported “*Calliandra haematomma* var. *correllii* Barneby is the only taxon of this species endemic to the Bahamas.” See Notes in Appendix I—*Calliandra haematomma* var. *correllii*.

Mimosa bahamensis Benth., Hooker’s Journal of Botany 4:408. 1842.

Notes: RRS:35 reported this species for San Salvador Island, with the common name, Haulback. C&C:664–665 reported a second common name, Bahama Mimosa, and considered the species endemic to the Bahamas; Areas 1–3, 5 (includes San Salvador Island), 8. Kass (1991:79, 2005:96, 2009:112) and Snyder et al. (2007) recorded the species for San Salvador Island. Acevedo-Rodríguez (2012:443), referencing C&C, considered the species “endemic to the Bahamas.” F,F-O&J:227 delisted the species, reporting distributions for Central America and Mexico.

FABACEAE (LEGUMINOSAE-Subfamily Caesalpinioideae), Pea Family

Caesalpinia reticulata Britton, Bulletin of the New York Botanical Garden 4:118. 1905.

Notes: RRS:36 listed this species for San Salvador Island, with the common name Net-veined Caesalpinia. C&C:606 listed the species with no common name, and identified it as endemic to the Bahamas; Areas 1–3, 5 (includes San Salvador Island). They noted (no reference cited) “should probably be considered only varietally different from *C. bahamensis*”, and they separately listed (pp. 602–603) *C. bahamensis* Lam. with distributions for Areas 1–10, Cuba. Earlier, Gillis (1974:156) had merged the species under *C. bahamensis*, which is not endemic to the Bahamas, and which Britton and Millspaugh (1920:173) reported from the Bahamas and Great Guana Cay, Cuba. Lewis and Acevedo-Rodríguez (2012:402, 404) accepted the name *C. bahamensis* Lam. subsp. *bahamensis* for the synonym *C. reticulata* Britton. They report the species as “Endemic to the West Indies; native to the Bahamas, Cuba, and Hispaniola.” F,F-O&J:227 delisted the species. We suggest using the currently accepted name for the San Salvador Island subspecies.

Cassia lucayana Britton, Bulletin of the New York Botanical Garden 4:138. 1906.

Syn: *Chamaecrista caribaea* (North.) Britton var. *lucayana* (Britton) H.S. Irwin & Barneby, Memoirs of the New York Botanical Garden 35(2):682. 1982.

Notes: C&C:621 reported this species as endemic for the Bahamas; Areas 5 (includes San Salvador Island)–8, 10. F,F-O&J:227 delisted this species, reporting that it “... is considered part of the *Chamaecrista caribaea* (North.) Britton complex”, of which “*Chamaecrista caribaea* var. *lucayana*” is considered endemic to the Bahamas. See Appendix I, for the endemic varietal form found on San Salvador Island.

MALVACEAE, Mallow Family

Hibiscus brittonianus Kearney, Leaflets of Western Botany 7:121. 1954.

Notes: RRS:42 listed the species for San Salvador Island. C&C:931 likewise recorded the species, and considered it endemic to the Bahamas; Areas 1, 3–10 (Area 5 includes San Salvador Island). Dorr (2012:507) treated this as a synonym of *Hibiscus clypeatus* L. subsp. *membranaceus* (Cav.) O.J. Blanch. ex F. Areces & Fryxell, reporting it as “Endemic to the West Indies; native to Bahamas, Cuba, and Haiti (Tortue Is.)”. F,F-O&J:227 delisted the species, reporting it as “endemic (*sic*) to the Bahama Islands, Cuba, and Haiti.”

RHAMNACEAE-Buckthorn Family

Ziziphus taylorii (Britton) M. Johnst., American Journal of Botany 51:1118. 1964.

Notes: RRS:41 listed this species for San Salvador Island. C&C:900 considered it endemic to the Bahamas; Areas 1–8 (5 includes San Salvador Island), 10. A-R&S:797 considered the species “Endemic to the West Indies; native to the Bahamas and Mona Is. (Puerto Rico)”. F,F-O&J:229 delisted the species, reporting that it also occurs in Puerto Rico.

RUBIACEAE, Madder Family

Spermacoce bahamensis (Britton) R.A. Howard, Phytologia 65:287. 1988.

Notes: RRS:50 listed this species for San Salvador Island as *Borreria bahamensis* Britt. C&C:1372 likewise recorded the species, and considered it endemic to the Bahamas; Areas 1–3, 5 (includes San Salvador Island), 7. A-R&S:802, 846 accepted the name *Spermacoce bahamense*, and considered the species endemic to the West Indies, native to the Bahamas, and Lesser Antilles. F,F-O&J:223 followed the taxonomy of Howard (1988) and of A-R&S, accepted the species within *Spermacoce* L., and delisted (p. 229) the species, reporting its unusual disjunct distribution between the Bahamas and the Lesser Antilles.

SOLANACEAE, Potato Family

Solanum bahamense L., Species Plantarum 1:188. 1753.

Notes: RRS:49 recorded this species for San Salvador Island, common name Bahama Solanum. Knapp (2012:907), reported the plant as native to the Bahamas, many islands throughout the West Indies, and the United States (FL). F,F-O&S:229 delisted this species, reporting that C&C did not provide details pertinent to the distribution status. Even though C&C:1289 did not list Area distributions in their incomplete species description for *S. bahamense* or mention an endemic status, we found that their “Distribution Table” (C&C:1600) recorded herbarium specimens collected in Areas 1–10 (Area 5 includes San Salvador Island). Furthermore, Kass (1991:87, 2005b:106, 2007:27, 2009:122) and Kass and Miller (2006) reported that the illustration of *S. bahamense* in C&C:1294, was mislabeled as *S. erianthum* (see correct figure legend, p. 1291), drawn from a Florida plant, and reprinted from Tomlinson’s book on trees native to tropical Florida (Tomlinson 1980:407). Therefore, the plant has not been considered a Bahama endemic for some time (FSU, Florida specimens; Tomlinson 1980:406–408, 2001:321–322).

VERBENACEAE, Vervain Family

Stachytarpheta fruticosa B.L. Rob., Proceedings of the American Academy and of Arts Sciences 51:531. 1916.

Notes: RRS:48 listed this species for San Salvador Island, with the common name, Bahama Vervain. C&C:1245 likewise recorded the species, and considered it endemic to the Bahamas; Areas 1–3, 5 (includes San Salvador Island), and 10. A-R&S:937 recorded this species as “Endemic to West Indies; native to Bahamas and Cuba.” F,F-O&J:230 delisted the species, reporting that it is also found in Cuba.