Endemism hotspots in the flora of Belize

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ABSTRACT

This thesis is aimed at improving the understanding of endemism (or 'bioquality') hotspots (areas where globally rare species are concentrated) within the flora of Belize, with a view to informing conservation priorities at scales suitable for practical land management. Research is framed within a standardised bioquality scoring system, whereby all species are allocated to 'Star' categories of global rarity. Based on this, the bioquality of different areas can be calculated and compared. Areas of high bioquality are considered priorities for conservation.

Chapter 1 discusses biodiversity loss and provides an overview of conservation prioritization exercises at various spatial scales, including Important Plant Areas and the assessment of bioquality within the Rapid Botanical Survey framework. This is followed by an overview of the study site which includes a brief history of vegetation research in Belize, and development of the National Protected Area System.

Chapter 2 describes the curation of a database of botanical records for Belize. Patterns in historical data are explored, revealing bias in the dataset; spatially, and in terms of taxonomic groups and habit types. Parts of Belize are found to be under-sampled. Areas close to settlements, research stations, and unusual geomorphological features are associated with high numbers of botanical records. Chapter 3 examines distribution patterns in observed bioquality data to determine how these relate to underlying geology and topographic diversity. A high percentage of hotspots are found on rugged limestone at mid - high elevations, and where there are transitions in underlying geology. Chapters 4 and 5 use two modelling methods to predict bioquality at a 1 km grid square resolution. Chapter 4 describes a bottom-up approach to predicting bioquality, based on stacking individual species distribution models (SSDM). Results show affinities to observed bioquality patterns, but a general tendency to over inflate bioquality. Chapter 5 describes the use of a top-down, macroecological (MEM) approach to modelling bioquality. This method produced more accurate predictions than those arising from the SSDM model. Three main areas where hotspots overlap on the SSDM and MEM maps (the western end of the Colombia River Forest Reserve, including Little Quartz Ridge and the Burgos Plateau; on the Vaca Plateau, near the border with Guatemala and eastwards into the Chiquibul Forest Reserve; and the limestone foothills on the eastern side of the Maya

Mountains, in the Bladen Nature Reserve) are considered priorities for further research (in situ sampling).

In the concluding chapter, hotspot predictions are examined within the context of the national protected areas system of Belize. Several areas that were predicted as high bioquality occur in places where there is currently little or no on-the-ground management. Several suggested refinements for the methodology are presented, and this chapter concludes with recommendations for the development of a national strategy for plant conservation.

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CHAPTER 1

General introduction

1.1 Biodiversity loss

According to recent estimates of modern extinction rates, it is likely that we are on the brink of a sixth mass extinction, largely brought about by human activities (Barnosky *et al.,* 2011; Ceballos *et al.,* 2015). The 2018 Living Planet Report (Grooten & Almond, 2018) states that wildlife populations have declined by over half in less than 50 years. Since we cannot reverse a decline in the variety of life on earth, we must work to ensure the survival of as many different species as possible. How to do this effectively remains one of our greatest challenges, not least because it requires the combined effort of scientists, politicians, and conservation practitioners, to name but a few. There is still a paucity of data for many areas, particularly the tropics (Prance *et al*., 2000a; Feeley, 2015), so there must be a greater effort to document biodiversity and to discover 'missing' species. Ultimately, we cannot protect biodiversity if we do not know what it is (taxonomically), or where it is.

The tropics are an area of particular concern as they are very diverse (Myers, 1988). Global tropical forest cover is declining with a reported loss in area of 9.9% from 1990 to 2015 (FAO, 2015). Watson *et al.,* (2016) reported 'catastrophic declines' of tropical wilderness areas in South America. Many low-income tropical countries do not have the resources to document biodiversity or to protect it from threats (Gordon & Newton, 2006). In a recent report, specific threats to plants, those already on the IUCN (International Union for the Conservation of Nature) Red List, were identified as habitat destruction and degradation. This is largely driven by land conversion (e.g. the expansion or intensification of farming), followed by biological resource use (e.g. logging), and residential and commercial development (Willis, 2017).

Funding for biodiversity conservation is limited so there is a need to make strategic, pragmatic decisions regarding the distribution of resources to implement any kind of action. The practice of 'ecological triage' (Hobbs & Kristjanson, 2003) and the prioritisation of important regions, ecosystems, habitats and species has become commonplace, and the term 'biodiversity hotspot' is now firmly embedded in the language of conservation.

1.2 Size matters: Conservation priorities at different scales

Developed as *'a systematic response to the challenge of large-scale extinctions ahead'* global biodiversity hotspots were first designated based on geographic areas known to contain high numbers of endemic plant species (with later versions including vertebrates), and experiencing high levels of habitat loss (Mittermeier *et al.*, 1998; Myers, 1988; Myers *et al.*, 2000). Amongst the criticism in the years that followed Myers' seminal work, there were suggestions that this exercise in global conservation prioritization had done little to inform on-the-ground conservation activities. In part, the problem stemmed from the scale of the proposed hotspots, the sheer size of which made implementation of activities virtually impossible due to the multilateral negotiations and large-scale collaborations that would be required (Brummitt & Lughadha, 2015). Various authors have called for the identification of conservation targets and priorities at finer scales (e.g. da Fonseca, 2000; Mace, 2000; Smith *et al.*, 2001).

The Critical Ecosystem Partnership Fund (CEPF, 2018) has achieved a great deal, not only by identifying conservation priorities and implementing strategies at regional and national scales, but also by engaging relevant government departments, NGOs and academic institutions (see Olivet & Asquith, 2004). The concept of 'Key Biodiversity Areas' (KBAs) was developed to help identify site-specific conservation targets, by building from a base of species-level IUCN Red List conservation assessments (Eken *et al.,* 2004). The process for identification of KBAs has been globally agreed. A site must meet one or more of 11 criteria, across five categories; threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes, and irreplaceability (IUCN, 2016).

The Convention on Biological Diversity (CDB) has done much to promote the creation and expansion of protected areas (Watson *et al.,* 2016). A publication arising from the recent World Parks Congress (Juffe-Bignoli *et al.,* 2014) reports that 20.6 million square kilometres (15.4%) of terrestrial areas (including inland waters) are officially protected in some way. However the issue of 'paper parks' (Bonham *et al.,* 2008) is widely known. This term refers to a protected area that is protected in name only; its protected status is likely to be reflected in national legislation, but physically, there is little or no effective management. Leverington *et al.*, (2010) assessed the effectiveness of protected area management at a global level. Data for 4,000 protected areas were analysed with respect to management effectiveness indicators: 24% of sites were soundly managed; 36% had basic management in place; 27% had major deficiencies; and 13% were deficient in terms of management (to the point where the protected area was not likely to be operating effectively). Also, the legal protection of many protected areas has been removed completely, areas made smaller, or switched to a lower level of protection (Mascia *et al.,* 2014).

Prioritisation of an area does not in itself preserve biodiversity. This can only be achieved by on-the-ground action. Monitoring & protection is often administered by local organisations (Brooks *et al.,* 2006). If current levels of biodiversity are to be maintained, the 'hierarchy of priority setting' (Mittermeier *et al.,* 1998) needs to continue to even finer scales (Whittaker *et al,.* 2005; Kew 2016b). There is a need for systematic sub-division within KBAs and within protected areas, many of which cover large expanses of land.

1.3 Important plant areas and bioquality hotspots

Thanks to millions of specimens stored in herbaria across the world, and the fact that plants are relatively easy to sample, hotspot analyses and other prioritisation exercises are often based on botanical data. At regional and national scales, Plantlife International initiated the designation of Important Plant Areas (IPAs) based on exceptional botanical richness and threatened habitats (Plantlife, 2016). A total of 1,750 IPAs have been identified globally in Europe, North Africa and the Middle East, and Kew are currently focusing on seven tropical countries via the Tropical Important Plant Areas programme (RBG Kew, 2016a). However, according to a recent 'State of the Worlds Plants' report (RBG Kew, 2016b), *'One in four European IPAs currently has no legal protection, many have no active management plan and a significant number are imminently threatened.'* Global and regional scale diversity hotspots for plants are well established, and national scale work is underway, but smaller local hotspots must be identified for effective conservation of plants (Murray-Smith *et al.,* 2008). A rapid, proactive, systematic response is required; one that is coordinated in collaboration with local land managers & conservation practitioners.

A simple and practical measure of conservation value that focuses on range-restricted global endemism is the assessment of 'bioquality', carried out within the Rapid Botanic Survey (RBS) framework (Hawthorne & Abu-Juam, 1995; Hawthorne, 1996; Baksh-Comeau *et al.,* 2016). Bioquality is an aspect of biodiversity that places emphasis on taxa that are globally rare. Bioquality is measured using the Genetic Heat Index (GHI). RBS utilises data from various sources (e.g. field sampling, specimens from herbaria) to infer patterns in the distribution of bioquality. Bioquality hotspots (GHI >250) are areas of high conservation value. Since bioquality can vary over short distances, the RBS framework is useful for informing fine-scale conservation priorities. Full details of RBS are provided in Chapter 3.

The idea for this research largely came from my experience of working as a botanist within protected area management in Belize, and was developed with my supervisor, William Hawthorne. The overarching goal was to define bioquality hotspots in the flora of Belize (with a view to informing priorities for conservation, at scales applicable to on-the-ground management), and to develop a methodology (that fits within the RBS framework) that would help to accelerate the discovery of hotspots.

1.4 Study site

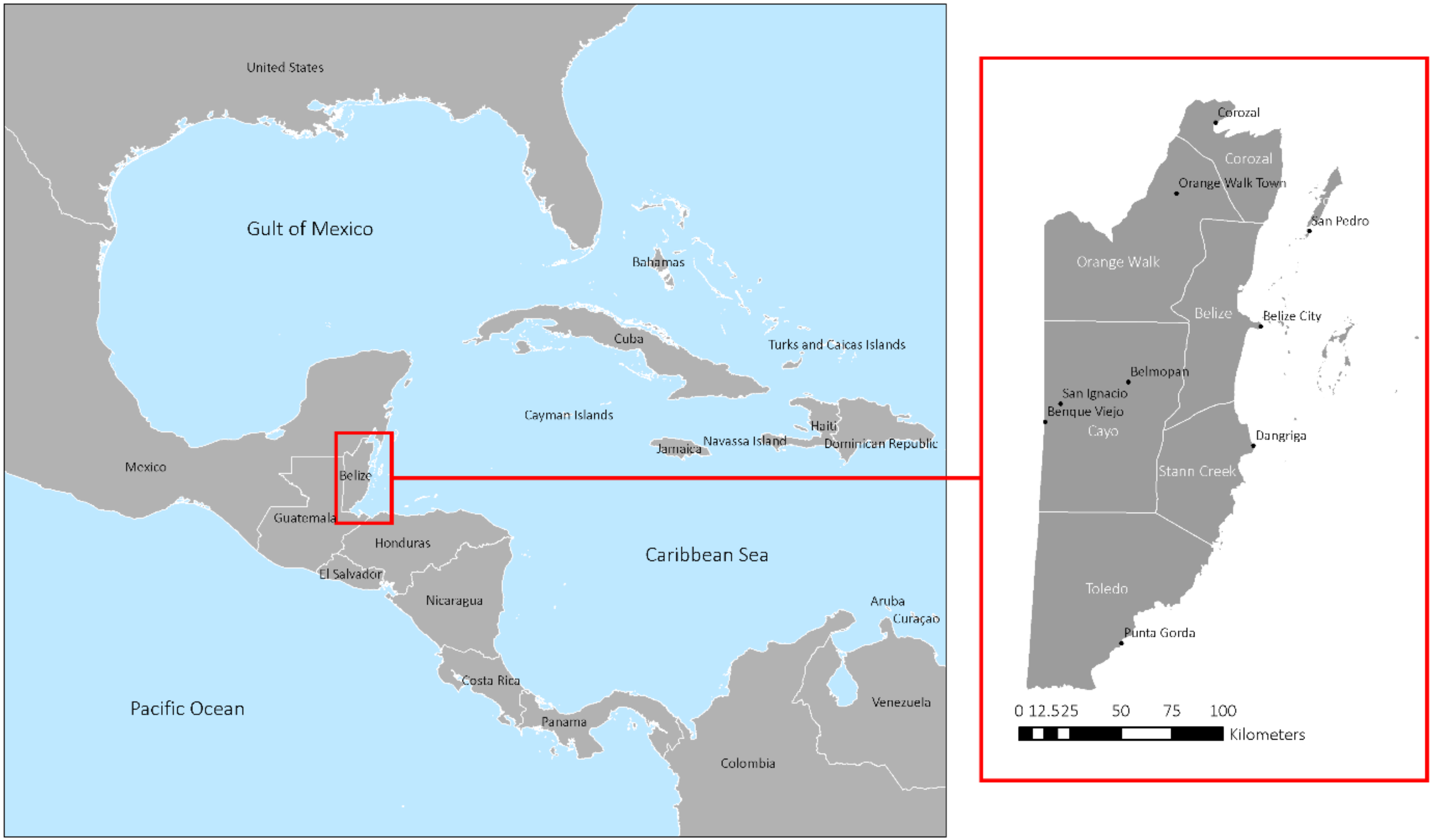
Location & climate

Belize is located on the eastern seaboard of Central America, bordered to the north by the Mexican state of Quintana Roo, to the west and south by the Guatemalan departments of Petén and Izabal, and to the east by the Caribbean Sea (see Figure 1.1). It is a small country (c. 22,963 square km, including the offshore cayes), approximately 280 km from north to south and 100 km from east to west at its widest part. Belize is divided into six administrative Districts, from north to south: Corozal, Orange Walk, Belize, Cayo, Stann Creek and Toledo.

Belize has a subtropical climate with mean annual temperatures ranging from 27°C in coastal areas to 21°C in the Maya Mountains, although there is considerable variation within this range. Nighttime temperatures as low as 10°C have been recorded in the Maya Mountains during the early part of the year (Bridgewater, 2012). There is a distinct wet (typically June - January) and dry (February - May) season, and a north to south rainfall gradient. The easterly Trade Winds rise as they pass over the Maya Mountains and this contributes to much higher precipitation in the south of the country. Annual mean precipitation ranges from 1,524 mm in the north to 4,064 mm in the south. There is considerable climatic variation within the Maya Mountains due to the rugged topography and variation in elevation (Penn *et al.,* 2004).

Tropical storms and hurricanes move westward through the Caribbean from June to November, peaking in September and October. Parts of Belize have suffered extensive damage from major hurricanes. Two thirds of the buildings in Belize City were destroyed by an unnamed storm in 1931, and after similar levels of destruction caused in 1961 by Hurricane Hattie, the government moved its buildings inland to Belmopan in 1970.

Figure 1.1. Location of Belize within Central America, and a map of Belize showing the six administrative districts (white text) and location of major towns (black text). All maps in this thesis are presented using World Geodetic System 1984 datum.



Geology & soils

Given its size, the geomorphology of Belize is very diverse. Geology and soils are relatively well known, largely because of extensive land resource surveys carried out by the British (Belize was formerly British Honduras until independence in 1981). The following text provides a summary of geological substrata, the major geomorphological features, and the main soil types found in Belize, with descriptions obtained from Ower, (1928); Wright *et al.,* (1959); and Baillie *et al.,* (1993). The geological map shown in Figure 1.2 is a simplified version of Cornec's (1986) geological map. This simplified version is used for analyses in later chapters of this thesis.

Limestones cover over 50% of Belize's territory and the majority were laid down during the Cretaceous period (between 100 MYA and 146 MYA) when most of Belize was covered by a shallow tropical sea. The northern half of the country is a relatively flat limestone plain (maximum elevation c. 120 m above sea level), similar to the southern part of the Yucatán Peninsula. The limestone-derived soils are typically shallow and stony with a clay-rich organic layer at the surface. They have neutral to alkaline pH levels, with a high calcium & magnesium content but few other nutrients. Depressions in the karst landscape usually contain colluvium (loose sediments washed down from surrounding areas).

Erosion by rain and rivers has transferred sediments down from higher elevations and together with littoral deposits, these form the flat coastal plain that stretches from Deep River in the Toledo District to Tower Hill in Orange Walk District. Soils are typically acidic and of low fertility. A dry, sandy topsoil and clay subsoil makes them susceptible to extremes of moisture content. In contrast, the 'continental red beds' (calcareous sandstones shales and slates in Figure 1.2) in the far south of the country are associated with pockets of very fertile soil. Mostly shallow, these soils are clay-rich, well-drained and slightly acidic, with moderate levels of calcium and magnesium. The most fertile areas of land in Belize are associated with riverine alluvial soils found in the centre of the country (south of the Belize River) and on floodplains along rivers in the Toledo District.

In the south, rising from the coastal plain, the Maya Mountains are a mosaic of sedimentary, metamorphic and igneous rocks. There is a central block of metamorphic rock (acid sandstones, shales and slates in Figure 1.2) formed during the Carboniferous period, 359 - 251 MYA, which is partially covered in the southwest with limestone (Holland, in Meerman & Matola, 1997). Soils derived from the metamorphic rocks are typically shallow, vary in texture from stony sandy loam to clay, are acidic and have low levels of nutrients. The western side of the Maya Mountains descends to the Vaca Plateau; an expanse of limestone with an elevational range of c. 400 - 725 m, bordered to the south and west by the Chiquibul River and to the east and north by the Macal River (Lundell, 1936).

Along the southern boundary of the acid sandstones, a strip of volcanic rock runs from east to west for c. 55 km. At the eastern end there is an isolated fault block ('Little Quartz Ridge') of c. 10 km in length, rising to a maximum elevation of c. 1,040 m. The name refers to the 'fin' of quartz-rich rock along the crest of the ridge (Meerman & Matola, 1997). Belize's highest point, Doyle's Delight[1] (1,124 m), is located on the main divide of the Maya Mountains, north of Little Quartz Ridge and c. 14 km from the Guatemalan border (Meerman & Matola, 2007). Here, as in other parts of the Maya Mountains, erosion of limestone has exposed the underlying bedrock. North of Little Quartz Ridge is the Burgos Plain, an area of approximately 40 square km, relatively flat but with karst cones, some of which are 50 - 60 m high. Holland (in Meerman & Matola, 1997) reports that it most likely formed as a graben (an elongated block lying between two faults).

The topographic complexity of southern Belize is largely due to the karstification of limestone, which forms a rugged 'cockpit' landscape of valleys and ridges in the foothills, with sinkholes and extensive subterranean cave systems. Karstification is reported to be particularly intense to the south and west of Little Quartz Ridge, resulting in deep, steep-walled valleys and large sinkholes. The oldest limestones in Belize form an arc to the north, west and south of the acid sandstones, shales and slates and includes the Vaca Plateau (Bridgewater, 2012).

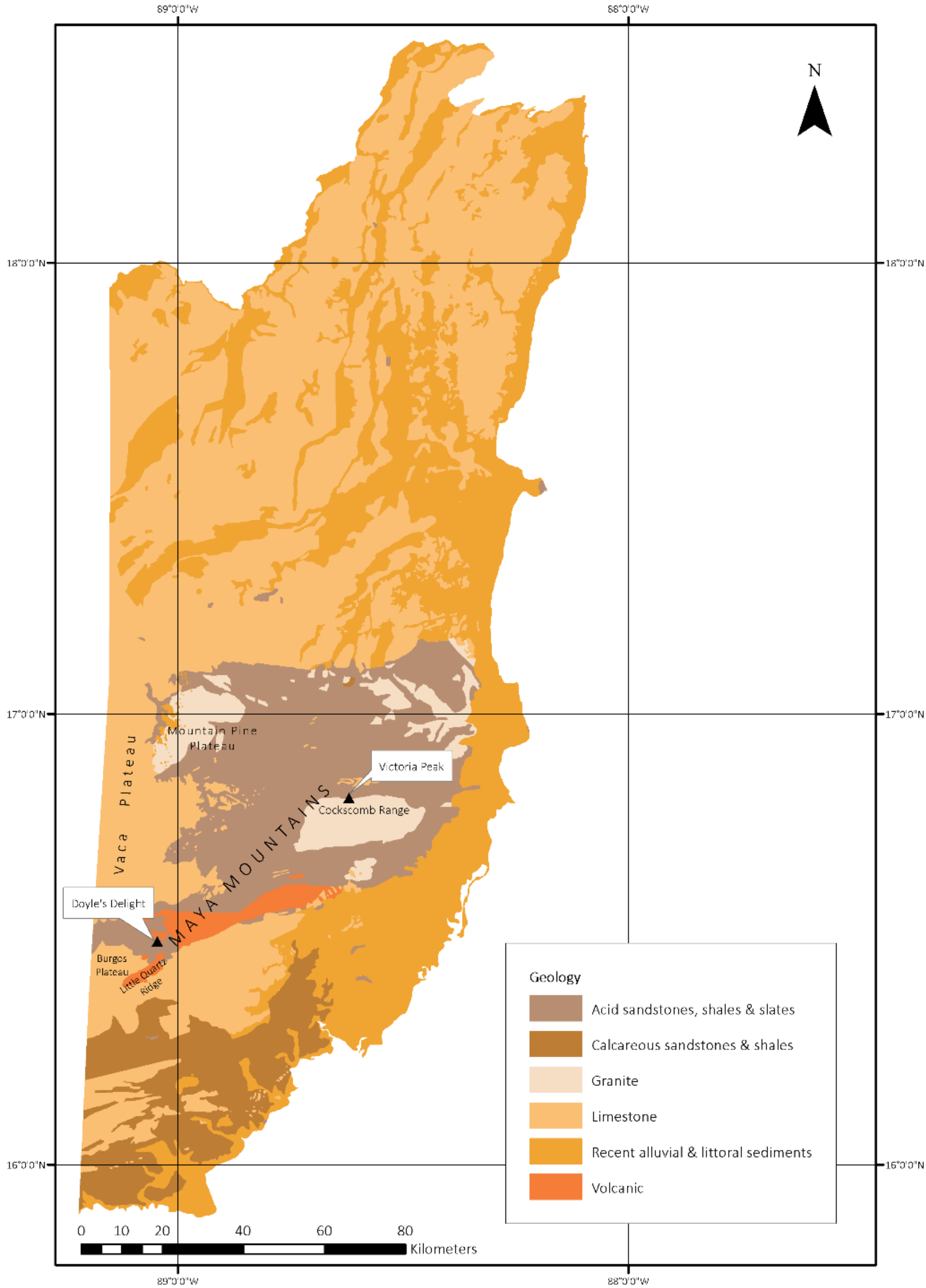
The Cockscomb Range is a spur at the northern end of Maya Mountains, running perpendicular to the main divide for approximately 16 km. The highest point in the range is Victoria Peak at 1,122 m. Granite (the oldest rock formations found in Belize, formed 444 - 359 MYA during the

[1] 'Doyle's Delight' refers to Arthur Conan Doyle and his 1912 book 'The Lost World'. Various expeditions to Belize's highest point led to it gaining a reputation as Belize's 'lost world'. The name first came into use in 1989.

Devonian period) underlies much of the Cockscomb Range, Cockscomb Basin and the Mountain Pine Plateau. The soils of the granitic intrusions are typically acidic with low levels of nutrients (although slightly higher than the soils of the coastal plain), heavily weathered and shallow, varying in texture from sandy loam to sandy clay.

The various gradients in moisture, temperature, and topography together with variation in soil type generated by underlying substrata, combine to support a diverse mosaic of vegetation types across Belize.

Figure 1.2. Geological map of Belize. This simplified version is based on Cornec's map of 1986. Data (shapefiles) were obtained from the BERDS website (Meerman & Clabaugh, 2017).



Botanical research and vegetation classification

The floristic composition of northern Mesoamerica is a result of the convergence of the Nearctic bioregions of North America with the Neotropical bioregions of South America, and the Greater Antillean bioregion of the Caribbean (Burnham & Graham, 1999). The complexity of the flora may be due in part to the dominance of limestone substrata across the region (Snead, 1980). Although globally uncommon, karst landscapes are found in approximately half of the Caribbean and 25% of Central America, including the Greater Antilles, the Yucatán Peninsula and the Petén region of Guatemala (Baden *et al.,* 2016, and references therein).

Early plant collecting and vegetation studies in Belize were linked to the exploration of potential land use for agriculture and exploitation of timber and other natural resources. Comprehensive accounts of the history of botanical collecting can be found in Spellman *et al.,* (1975), Brokaw (2001), and Balick *et al.,* (2000). Collecting is reported to have begun in the late nineteenth century with c. 220 specimens collected by 1894. No significant collections were amassed until Morton E. Peck visited the country between 1905 and 1907, collecting c. 1,000 numbers. Other notable collectors during the first half of the twentieth century included Cyrus L. Lundell (c. 3,000 numbers between 1928 and 1936), and William. A. Schipp who collected at least 3,500 numbers between 1929 and 1941. The Belizean botanist Percy Gentle, initially under the direction of Lundell, collected around 10,000 numbers between 1931 and 1958.

Prolific collectors during the latter part of the twentieth century and up to and including the present day include the following, with numbers in brackets indicating the number of collections shown on the Tropicos website (Tropicos, 2018); John D. Dwyer (3,867), Gerrit Davidse (c. 3,055), Caroline Whitefoord (c. 2,274), Steven W. Brewer (1,745), and Thomas B. Croat (1,565). As institutions, Missouri Botanical Gardens, New York Botanical Gardens, the Natural History Museum London and the Royal Botanic Garden Edinburgh have made substantial contributions to documenting the flora of Belize.

At a time when much of Belize was still largely unknown in terms of botany, Sprague and Riley (1924) estimated a total flora of at least 4,000 species (based on the known flora of Jamaica). Schipp's catalogue *'Flora of British Honduras, Pricelist of Seeds and Herbarium Material'* (his collecting efforts were primarily a business venture) represent the first Flora ever compiled for the south of the country (Lowden, 1970). *Flora of Guatemala* (Standley *et al.,* 1946-1978) attempted to include all species known from Belize and is still used by botanists working there today. A list of the monocots of Belize was published in 1975 (Spellman *et al.,* 1975), followed by a list of the dicots of Belize in 1981 (Dwyer & Spellman, 1981). In 2000, Balick *et al.,* published *'A Checklist of the Vascular Plants of Belize'*. This was based on examination of c. 17,000 specimens and presented a list of 3,408 accepted names (species and infra-specific taxa).

A simple comparison of botanical records per country (for Central America) is shown in Table 1.1. A total of 35,383 specimen equates to 15 records per 10 km^2, suggesting that the flora of Belize is relatively well collected, certainly in comparison to the flora of Guatemala or Honduras.

Table 1.1. Number of specimens for each country in Central America. Data obtained from the Tropicos website.

Country	Number of records*	Total area (km^2)	Recs per 10 km^2
Costa Rica	232,161	51,100	45
Panama	191,588	75,417	25
Belize	35,383	22,966	15
El Salvador	26,311	21,041	13
Nicaragua	155,205	130,375	12
Guatemala	46,174	108,889	4
Honduras	46,281	112,492	4

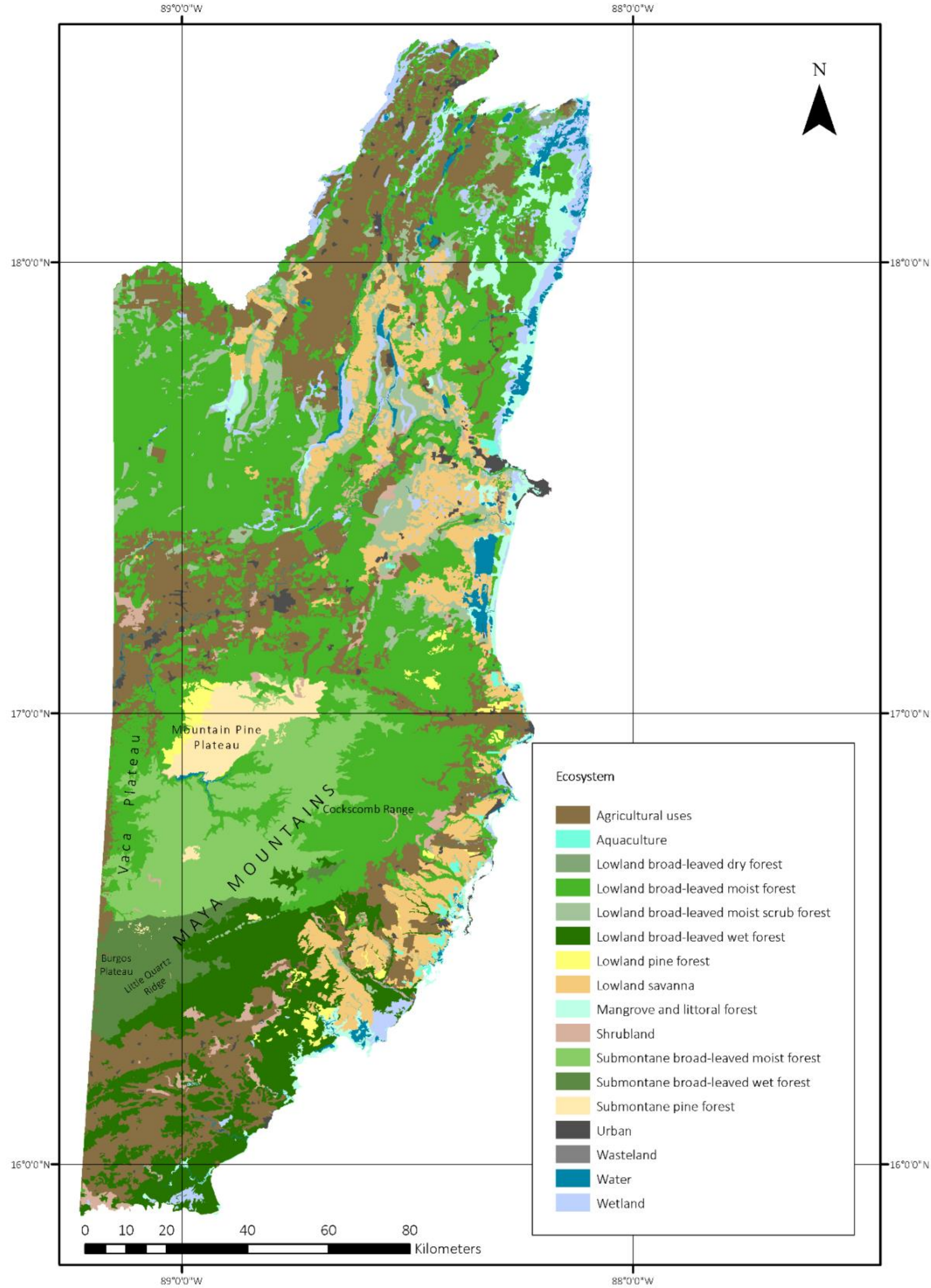
*Note that the number of records per country is likely to be higher than figures obtained from Tropicos. This is because specimens held at other herbaria may not necessarily have duplicates at Missouri Botanical Garden and thus are not part of the Tropicos dataset. Therefore, number of collections per unit area are likely to be slightly higher than the figures presented here.

Belize still does not have its own comprehensive Flora, although *Flora Mesoamerica* (Davidse *et al.,* 1994+) will include all Belizean taxa when completed. There are a small number of published checklists for specific habitats or vegetation types (e.g. Urban *et al.,* 2006; Goodwin *et al.,* 2013; Baden *et al.,* 2016), as well as numerous reports that include botanical data collected during exploratory expeditions and Rapid Ecological Assessments (e.g. Meerman & Williams, 1995; Meerman, 2004; Brewer *et al.,* 2013). Checklists have also been compiled for individual protected areas (usually a collation of historical data and new collections in the field) as a way of providing managers with baseline biodiversity data (e.g. Bridgewater *et al.,* 2006;

Brewer, 2011). The pace of this work is slowed primarily by the difficulty in obtaining funding for botanical inventories, but also by the lack of a comprehensive Flora, in combination with limited in-country capacity for botanical research.

At the regional scale, the (climax) vegetation of Belize is classified as subtropical moist forest and subtropical wet forest under the Holdridge life zone system (Holdridge, 1967). One of the earliest known descriptions of the vegetation of Belize was by Daniel Morris in *'The Colony of British Honduras, its Resources and Prospects'* (Morris, 1883). Additional information was then presented in *'Report on the forests of Honduras'* (Hooper, 1887) and in *'Report on the Economic and Natural Features of British Honduras'* (Dunlop, 1921). Between these reports, four main vegetation types were suggested (mangrove swamps, cohune ridge, broken ridge and pine ridge), with Dunlop also mentioning coastal savannas. Neil Stevenson's (1938) *'The evolution of vegetation survey and rural planning in British Honduras'* contributed a great deal to the knowledge of Belize's vegetation types, recognising links between geology, topography, and moisture. Published in 1959 as a result of extensive land surveys (for agricultural potential), *'Land in British Honduras'* (Wright *et al.,* 1959) is regarded as the seminal text for vegetation classification in Belize, describing 18 main classes of vegetation and 77 sub-types based on soil-moisture-plant relationships. The vegetation map most widely used today (see Figure 1.3) was developed as part of the Central American Ecosystems Mapping Project (Meerman & Sabido, 2001). It was essentially an update of Iremonger & Brokaw's 1995 version (in Wilson (Ed.)., 1995), which itself was largely based on the vegetation map of Wright *et al.,* (1959).

Figure 1.3. Ecosystems of Belize. This is a simplified version (marine ecosystems are not shown) of the revised 2015 map produced by Jan Meerman. Classification follows the UNESCO system developed for the Central American Ecosystems Map. Data (shapefiles) were obtained from the BERDS website (Meerman & Clabaugh, 2017).



Biodiversity and endemism

Belize is part of the Mesoamerican Biodiversity Hotspot (Myers *et al.,* 2000), which also includes all of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, a third of Mexico and c. two thirds of Panama (subtropical and tropical ecosystems). Within this, the Selva Maya region (which includes Belize, northern Guatemala and south-eastern Mexico) contains the second-largest area of continuous (sub-)tropical forest in the Americas after the Amazon forest (Selva Maya, 2018).

The Petén-Veracruz Moist Forest ecoregion extends from central Veracruz and parts of Oaxaca, Tabasco, Chiapas and Campeche in Mexico, through northern Guatemala and into Belize. It is considered an endangered ecoregion due to high rates of deforestation and is well represented in Belize. Pine forest (most of which is found on the Mountain Pine Plateau, see Figure 1.3) in Belize is one of the few examples of lowland and pre-montane pine forests in the Neotropics. The Yucatán Moist Forest (limited to the north east of Belize and shown on the map as 'lowland broadleaf moist forest') has high levels of endemism and is considered globally vulnerable (Olson *et al.,* 2001).

The Maya Mountain massif was identified as one of 24 Key Biodiversity Areas (KBAs) in Northern Mesoamerica, based on its biological importance and conservation potential (Olivet & Asquith, 2004). These KBAs are regarded as high priorities for conservation, based on vulnerability and irreplaceability. For Belize, the KBA analysis was based on BirdLife International's Key Areas for Threatened Birds in the Neotropics (Wege & Long, 1995). Existing protected areas containing globally threatened species (i.e. species assessed using IUCN Red List categories and criteria) were also included in the analysis (further details of the analysis can be found in Olivet & Asquith, 2004).

The revised National Protected Areas System Plan (Salas & Shal, 2015) also identified the Maya Mountains as a Key Biodiversity Area using Marxan (2018) analyses; one focusing on presence of IUCN Red List species, and the other included species of national concern. The core priority area produced by the analysis included Bladen Nature Reserve, Chiquibul National Park and Columbia River Forest Reserve (see Figure 1.4, and list of protected areas in Appendix 1).

Early literature suggested that plant endemism in Belize was likely to be low (Standley & Record, 1936) and this was confirmed by Balick *et al.,* (2000), who recognised 1.2% of the flora (41 species) as endemic. Endemism is better examined in the context of phytogeographic regions. Balick *et al.,* (2000) suggested five phytogeographic units: forests on limestone of Petén (Guatemala) and north western Belize; the coastal plains of southern Yucatán (Mexico) and Belize (which would include lowland savanna); the forests of the Mountain Pine Plateau area of Belize; the lowland moist and wet forests of the Maya Mountains (Belize and Guatemala); and the montane wet forests of the higher elevations of the Maya Mountains. Balick *et al.,* (2000) also highlighted the importance of the savanna ecosystem for endemics. This was confirmed by Goodwin *et al.,* (2013) for lowland savanna. The Mountain Pine Plateau (most of which falls within Mountain Pine Ridge Forest Reserve) has also been suggested as an important area for endemics that occur within the high elevation savanna (Walker & Walker, 2007) and within gallery forests (Penn *et al.,* 2004).

Forests on karst outcrops in the foothills of the Maya Mountains have been shown to support a high number of tree taxa endemic to northern Mesoamerica, whereas lower elevation forests in valleys are composed largely of tree species with a wider Neotropical distribution (Brewer *et al.,* 2003). The upper elevation forests of the Maya Mountains remain relatively intact but are poorly studied. Conducting research is challenging due to difficulties in traversing rugged and remote terrain. For northern Central America, the Maya Mountains are considered geologically 'old' and it is possible that they acted as a biological refugium when the rest of Belize was covered by a shallow sea. These forests are ecological islands, occupying a small area, with environmental conditions unique for Belize. They are vulnerable to disturbance, and similar ecosystems in many other parts of Central America have been severely degraded (Meerman & Matola, 1997). Brewer *et al.,* (2013) reported a 'nearly unique' flora in forests on the south-east face of the Maya Mountains at an elevation of c. 1,000 m when compared to forest at lower elevations. Collections from Little Quartz Ridge indicate that the flora is composed of species with restricted ranges and shows affinities to the highlands of Guatemala (Walker & Walker, 2009).

The National Protected Areas System

The following text presents a brief history of the development of Belize's National Protected Area System, highlighting key points that relate to the establishment of terrestrial protected areas. A comprehensive account is presented in Young & Horwich (2007).

Exploitation of timber resources was the basis for British settlement in Belize. Firstly, 'logwood' *(Haematoxylum campechianum)* in the seventeenth century, then mahogany *(Swietenia macrophylla)*, cedar *(Cedrela odorata)*, and other hardwood species. Dependence on forestry continued (sparing much of Belize's forest cover from land conversion) until the late 1950s, when the primary source of income for the country began to shift to large-scale agriculture[2]. Control of all unclaimed land in Belize was given to the Crown (government) under the Crown Land Ordinance of 1817. The Forests Ordinance of 1927 was the first piece of legislation that regulated the use of forest resources in Belize, in that it gave government officials the authority to set aside forest reserves for regulated timber extraction. The Forest Department was established in 1935 and currently falls under the jurisdiction of the Ministry of Agriculture, Fisheries, Forestry, the Environment and Sustainable Development and Immigration.

Silk Grass, Mountain Pine Ridge and Columbia River were among the first forest reserves to be designated. Fifteen forest reserves (covering almost 20% of Belize) had been established by the time Belize gained its independence in 1981 (Hartshorn *et al.,* 1984). The first nature reserve, Half Moon Caye, was established in 1982 to protect the population of red-footed boobies (*Sula sula*). The first private protected area (Rio Bravo Conservation & Management Area) was established in 1988 by Programme for Belize (a non-governmental organisation).

Belize signed the Convention on Biological Diversity (CBD) in June 1993. In 1997, with assistance from the United Nations Development Program and the Global Environment Facility, Belize began preparation of a National Biodiversity Strategy, and a National Biodiversity Action Plan. Both were reported as *'completed and adopted'* in the second national report to the CBD, published in February 2002. The CBD also motivated completion of the National Protected

[2] In 2017, exports of sawn wood accounted for only BZD6.47 million (USD3.23 million), with sugar being the main domestic export at a value of BZD148.04 million (USD74.02 million), followed by bananas, then citrus concentrate. Data downloaded from The Statistical Institute of Belize http://sib.org.bz/

Areas System Plan (Meerman & Wilson, 2005), which was ratified by the Government of Belize in 2006. The final document was a result of a series of consultancies carried out by members of the National Protected Areas Task Force between 2004 and 2005. Meerman and Wilson's (2005) map of the protected areas system was revised in March 2015 and is shown in Figure 1.4. Approximately 36% of Belize's terrestrial area is currently under some form of protection. Table 1.2 lists the management categories for protected areas managed by the Forest Department.

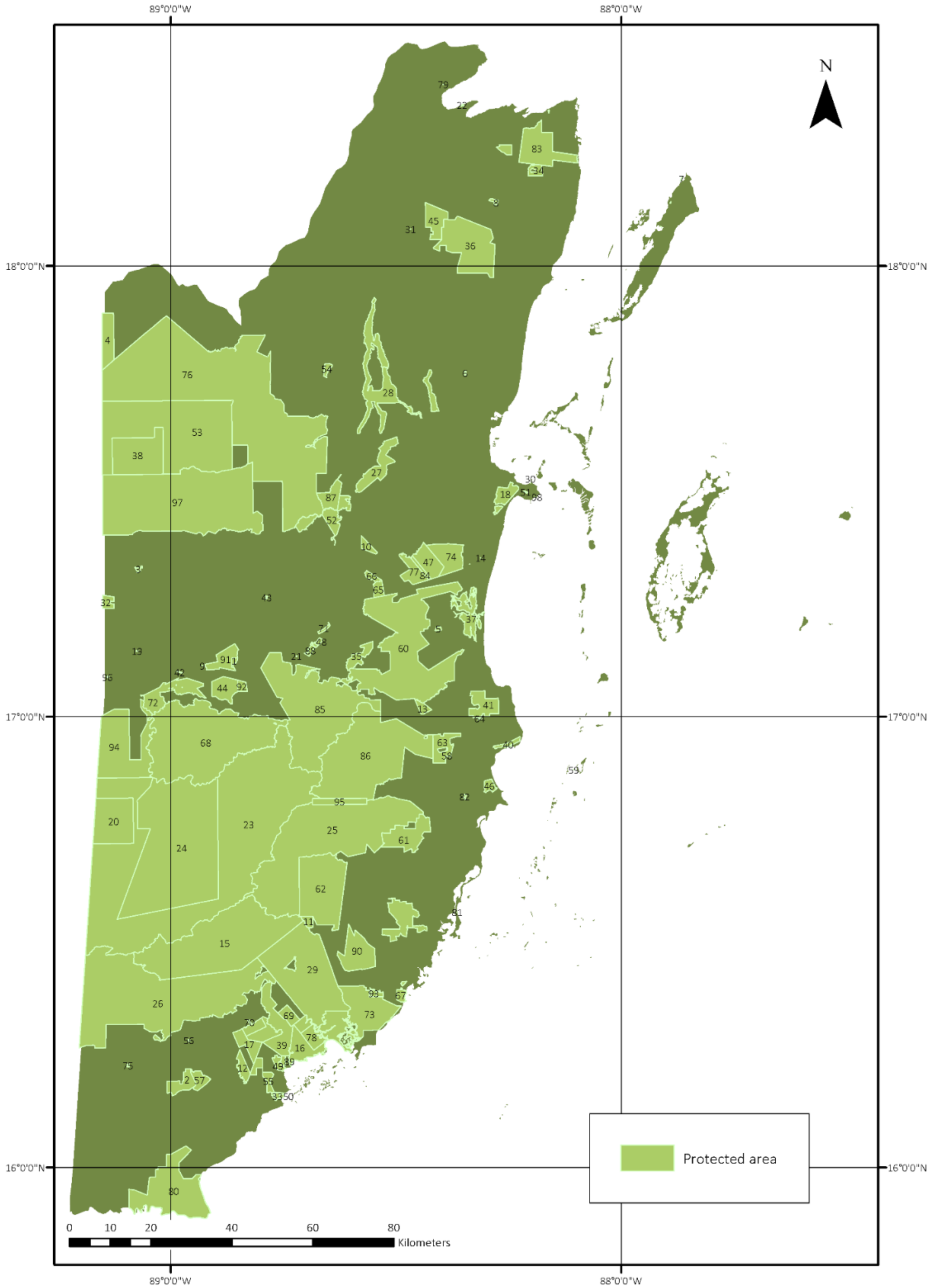
The Protected Area Conservation Trust Act was passed in 1995 (amended in 2015), with the purpose of financing conservation activities in Belize's protected areas, and to establish a trust fund which came into effect on 1st June 1996. Revenue is largely generated from a percentage of the departure tax[3] paid on leaving the international airport, and by cruise ship passengers.

Table 1.2. The five management categories for terrestrial protected areas currently under the administration of the Forest Department. Number in brackets indicates number of protected areas in Belize currently recognised under this category. Information obtained from Walker & Walker (2013). The NPAS map in Figure 1.4 also shows private protected areas and archaeological sites (NTFP = Non-Timber Forest Product).

Category	**Purpose**	**Activities permitted**
Forest Reserve (18)	To protect forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources.	Research, education, tourism, logging, NTFP extraction.
Nature Reserve (4)	To protect biological communities or species, and maintain natural processes in an undisturbed state.	Research & education.
National Park (17)	To protect and preserve natural and scenic values of national significance for the benefit and enjoyment of the general public.	Research, education, tourism.
Wildlife Sanctuary (8)	To protect nationally significant species, biotic communities or physical features.	Research, education, tourism.
Natural Monument (5)	To protect and preserve natural features of national significance.	Research, education, tourism.

[3] According to the 2016 PACT Independent Audit Report (downloaded at https://www.pactbelize.org/fiduciary-services/), total revenue from departure tax for 2016 (the most recent data available) was BZD2,950,425.00.

Figure 1.4. The National Protected Areas System of Belize (excluding marine protected areas). Numbers correspond to the list of protected areas in Appendix 1. This version is based on data (shapefiles) obtained from the BERDS website (Meerman & Clabaugh, 2017).



Threats and challenges for conservation in Belize

Globally, protected areas are at the core of efforts to achieve the long-term conservation of nature and the services it provides. Effectively managed protected areas (and protected area networks) are recognised as vital to achieving the objectives of the Convention on Biological Diversity (IUCN, 2018). There is concern that many protected areas are not achieving these objectives (Stolton *et al.,* 2003; Leverington *et al.,* 2010), and that despite increasing protected area coverage across the globe, biodiversity continues to decline (Juffe-Bignoli *et al*., 2014). One of the possible reasons for this decline is ineffective management of protected areas. Coad *et al.,* (2015) suggest there is emerging evidence that well-managed protected areas are effective but that understanding what constitutes 'good management' is an ongoing debate. It is beyond the scope of this chapter to fully discuss what constitutes 'effective' (or 'good') management, but we refer to the World Commission on Protected Areas (WCPA) framework, which is based on the idea that good management follows six distinct elements: '*it begins with understanding the **context** of existing values and threats, progresses through **planning**, and allocation of resources (**inputs**), and as a result of management actions (**processes**), eventually produces products and services (**outputs**), that result in impacts or **outcomes**.'* (Stolton *et al.,* 2003).

On paper, the National Protected Areas System of Belize is impressive. Relative to other central American countries, Belize has the highest percentage of land under some form of protection[4]. The Forest Department is mandated by legislation to provide management to all protected areas designated under the Forest Act and the National Parks System Act (Salas & Shal, 2015), but it has long been recognised that the Forest Department have insufficient resources to manage the entire network effectively. Belize's second National Report to the CBD (Sabido, 2002) stated that a reduction in government funds allocated to the Forest Department (the focal point for the CBD) resulted in *'significant delays and lack of resources required for the implementation of the convention, particularly by the government sector.'* The report goes on to state that as a result, non-governmental organisations (NGOs) and community-based organisations were largely responsible for implementation of actions relating to the CBD. This continues to be the case in Belize today, with 15 NGOs or community groups currently engaged

[4] According to the World Database on Protected Areas (data available to view and download at www.protectedplanet.net), Belize currently has 37.6% of its terrestrial area under some form of protected status, followed by Nicaragua (37.2%). El Salvador has the lowest percentage of protected land in Central America (8.78%).

as co-managers of protected areas[5]. On-the-ground management of protected areas varies considerably across the country. Some have permanent ranger teams carrying out regular patrols (e.g. Friends for Conservation and Development in the Chiquibul Forest Reserve), and two co-managers have also established biodiversity monitoring programmes (Ya'axché Conservation Trust, and the Toledo Institute for Development and the Environment), while other protected areas have little or no active management in place.

The development of a national evaluation framework for protected area management effectiveness was included in the National Protected Areas Policy and System Plan (Meerman & Wilson, 2005). The results of a comprehensive assessment of the protected area network were presented in *'The status of protected areas in Belize'* (Walker & Walker, 2009). The outputs from the indicators of the monitoring tool used for the assessment (see Young *et al.,* 2005) rated Belize's national protected area system as 'moderate' in terms of its management effectiveness (average a score of 2.44 out of a possible 4.0 across the system). Among the nine areas of concern listed in the report, management actions such as surveillance and enforcement were suggested to be severely inadequate, and limited financial sustainability and viability was cited as a major weakness.

A protected area cannot function effectively if there are inadequate resources to support the development of management plans, and to implement associated management actions on the ground. Despite the existence of the Protected Areas Conservation Trust as a funding source, it is a struggle for the Forest Department and for co-managers to find sufficient continuous financing for core costs such as vehicles and ranger salaries. Funding for conservation in Belize is largely project-based, with specific outcomes and targets that must be met. Most project-based funding lasts for three to five years. It is unsurprising that very few co-managers have managed to develop and sustain regular biodiversity monitoring. In recent years, funding opportunities appear to have gradually shifted focus from inventory work and rapid ecological assessments, to projects with sustainable development goals, targeting the improvement of local livelihoods.

[5] Data obtained from the attribute table that relates to the shapefile for the National Protected Areas System of Belize. Available to download at http://www.biodiversity.bz/

The ecosystems of Belize face numerous threats. Forest cover is reported to be decreasing[6], down from c. 76% in 1980 to 63% in 2010. This represents an annual deforestation rate of 6% (an average loss of 24,835 acres of forest per year). During this period, 15.2% of deforestation occurred within protected areas (Cherrington *et al.,* 2010). Chicas *et al.,* (2016) expressed concern for several protected areas adjacent to the western border with Guatemala, where illegal settlements along the border have resulted in deforestation. Their study (a time-series analysis of Landsat imagery from 1991 – 2014) covered an area of 97,794 ha. Results suggested that by 2014, the total forest cover of the area had been reduced from 89.99% (88,002.3 ha) to 58.47% (57,176.8 ha). Forest loss in Belize is largely driven by the expansion of commercial-scale agriculture (citrus, bananas, sugar cane). Subsistence agriculture (often employing slash-and-burn practices) is also problematic (Young, 2016). In addition, hydropower development (Lanza & Chernaik, 2016), oil exploration (Llewellyn, 2012), and increasing demand for high-value hardwoods (Belize Forest Department *et al.,* 2012; Ya'axché Conservation Trust, 2013), could have (or already have had) negative effects on habitats and species.

As well as the encroachment of agricultural land into protected areas, dereservation of portions of protected areas has occurred in the past. In 2009, the Bladen Nature Reserve was illegally entered for the purposes of a feasibility study for a hydroelectric dam on the Central River (pers. comm., Ya'axché, 2015). If Belize is to retain the integrity of its protected area network, and the health of its ecosystems in perpetuity, land managers must strike a balance between meeting the development demands of a rapidly growing population and protecting biodiversity. To do this, evidence-based decisions must be made as to which areas should remain intact, and which are more suitable as multiple-use zones for activities such as agroforestry, or resource extraction. There is a need for a rapid, nationally coordinated, systematic approach to delimiting areas of high conservation value at scales suitable for practical land management.

The main aims of this research are as follows:

1. To assess the flora of Belize within a conservation science framework, focusing on the bioquality approach detailed in Chapter 3.

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[6] According to FAO (Food and Agricultural Organization of the United Nations) data, between 2000 and 2015, Belize had an average annual forest cover change rate of -0.44% (an average annual loss of c. 6,200 hectares), which is one of the lowest change rates for Central America. For comparison, Nicaragua had the highest verage annual change rate for the same period (-1.34%, or an average annual loss of c. 46,600 hectares). Data available to view and download at http://www.fao.org/forest-resources-assessment/past-assessments/fra-2015/en/

2. To ascertain where globally rare species, and therefore bioquality hotspots, are known to occur.
3. To investigate factors that lead to the bioquality patterns described, and to compare two modelling approaches to interpolate bioquality across the whole country.
4. To discuss predicted hotspots in the context of Belize's protected area system.

1.5 Thesis structure

This thesis is comprised of six chapters (including this introductory chapter). Chapters 2 - 5 are presented in journal manuscript format and follow the structure of Introduction, Materials & Methods, Results, and Discussion. Supplementary information for each chapter is presented in appendices at the end of the thesis, together with a list of references for all chapters.

Chapter 2 - Assessing the status of vascular plant data for Belize. The first section details the methodology for populating and curating a vascular plant database for Belize. This includes the protocol for generating a working checklist of accepted names, and work undertaken to reduce error in the dataset. Analyses of bias in the dataset are presented, as well as estimates of species richness and sampling completeness across different habitats and habit types.

Chapter 3 - The distribution of bioquality in relation to geological and topographic diversity. This chapter details the methodology for collating global distribution data, assigning species to Stars, and developing a Star framework for Belize as per the Rapid Botanic Survey framework. A preliminary bioquality map is generated from botanical records in the database. This is examined alongside existing geological and topographic data to determine patterns in the distribution of bioquality.

Chapter 4 - Modelling species richness and bioquality using stacked species distribution models. Outputs generated from individual species distribution models are stacked to produce a map of predicted species richness and community composition. GHI is calculated from the resulting species lists to produce a map of bioquality predictions for Belize. The reliability of predictions is tested using an independent dataset of RBS samples collected in Belize and Quintana Roo, Mexico. Bioquality predictions are examined in relation to underlying geology and topographic complexity.

Chapter 5 - Macroecological modelling of bioquality. GHI scores per unit area (generated using botanical records from the Belize vascular plant database) are treated as the response variable within a species distribution modelling framework to produce a bioquality map for Belize. The reliability of predictions is tested using an independent dataset (see above). Bioquality predictions are examined in relation to underlying geology and topographic complexity. Bioquality maps from the two modelling methods are examined to determine the extent of variation between predictions. Discussion includes a critical evaluation of strengths and weaknesses of the two modelling methods.

Chapter 6 - Conclusions. This chapter includes a summary of results. The location of hotspots is discussed in the context of conservation and protected area management in Belize. This chapter concludes with recommendations for the refinement of the modelling methods, and future work, including the development of a framework for a national strategy for plant conservation.

CHAPTER 2

Assessing the status of vascular plant data for Belize

2.1 Introduction

Inventory of the tropical flora is incomplete (Prance *et al.,* 2000a; Feeley, 2015) and this presents a significant barrier to the conservation of species and habitats (Krupnick, 2013). Low-income tropical countries often have high biodiversity (Myers, 1988), and baseline species data are an essential foundation for the development of effective protected area design and management. It can be difficult for protected area managers to directly obtain funds for inventory work, or rapid ecological assessments, because the results are seen (by potential donors) as having no direct impact on actual on-the-ground conservation, or as being of little direct benefit to local livelihoods, unless local people are employed on the inventory (pers. comm. Ya'axché Conservation Trust & Toledo Institute for Development and the Environment, 2016). This is a somewhat ill-advised viewpoint since we cannot even begin to effectively manage the biodiversity of an area if we do not know what is there in the first place.

As more data become available online via the Global Biodiversity Information Facility (GBIF) or other online repositories, datasets of herbarium specimens are increasingly used to estimate plant species richness, diversity, or endemism (Greve *et al.,* 2016) as part of conservation priority setting exercises at global, regional, and national scales. It is well known that these datasets have their limitations. Bias and error are likely to affect estimates and that in turn could result in the setting of priorities that are based on misleading information (Tobler *et al.,* 2007). A recent study (Goodwin *et al.,* 2015) suggested that large numbers of herbarium specimens are wrongly named (i.e. the current name, as suggested in a taxonomic revision, is not reflected on the specimen). Geographic data can also be problematic (Soberón & Peterson, 2018). Locality information written on herbarium specimen labels is variable in the amount of detail provided. Limited geographic data makes records far less useful for fine-scale biogeographical studies. Older collections often list localities which may no longer exist due to name changes. Errors in transcription of coordinates from GPS device to label are common.

The distribution of the localities of collections is often uneven (Newbold, 2010). Historically, there has been a tendency to collect in easily accessible areas, or along roadsides, resulting in a high density of specimens recorded for a small number of areas (road and river lines are almost always visible when collection data are mapped). Consequently, there may be relatively few collections in areas that are difficult to access. Patchy coverage may also be due to the coarse resolution of coordinates. Numerous records may have the exact same coordinates (e.g. those corresponding to a research station) but were in fact collected from a much wider area. It may be possible to adjust and refine the coordinates if there is a detailed description of the location on the label. Linked to issues of spatial coverage, observed species richness increases with sampling effort. Geographic areas that are defined as 'centres of diversity' may well simply be areas that have high numbers of collections (Ahrends *et al.,* 2011). In cases where a systematic sampling method has not been used, there may be a bias towards documenting material that is deemed 'rare' or 'interesting' by the collector. This can result in 'less interesting' species (often those that are abundant) being under-collected.

Belize does not currently have a published national Flora (see Chapter 1 for a summary of botanical research). Most botanists and plant ecologists working in country use *Flora of Guatemala*. Balick *et al.,* published the *Checklist of the Vascular Plants of Belize* in 2000, and while this remains a very useful resource, a revision is required so that recent taxonomic circumscription and new records for the country can be included. The lowland savannas are probably the most well documented ecosystem as far as floristics are concerned, largely because of the Darwin-funded Savanna Ecosystem Assessment (see below). The flora on limestone has been well-documented relative to the other underlying geological substrata present in Belize (see analyses in Chapter 3; also Bridgewater *et al.,* 2006; Furley & Newey, 2006; Brewer & Dourson, 2012; Baden *et al.,* 2016).

There is currently no national strategy for plant conservation in place. For a country the size of Belize, a national strategy would be relatively straightforward to plan and implement (see Chapter 6). A comprehensive database of botanical records is an ideal starting point for this because it facilitates the assessment of bias and gaps in data collection (e.g. taxonomic, or geographic), and therefore helps to determine the appropriate steps towards completing the floristic inventory of Belize.

Objectives

To provide a summary of the status of vascular plant data currently available for Belize.

2.2 Materials and methods

Populating the database

A BRAHMS (Botanical Research And Herbarium Management System, version 7.9) database of vascular plant records (hereafter referred to as 'Belize database' or 'Belize dataset') was inherited from a previous project; Darwin Initiative Project 17022, *'Conservation of the lowland savanna ecosystem of Belize'* (Darwin Initiative, 2018a). Funded by the UK Government Department of Environment, Food and Rural Affairs, the project was a collaboration between the University of Edinburgh, the Royal Botanic Garden Edinburgh and the Environmental Research Institute at the University of Belize. Plant names in this version of the database included all those listed in Balick *et al.,* (2000). Data (botanical records) were obtained directly from the herbaria of Missouri Botanical Garden, Natural History Museum London, Belize Forest Department, and the Royal Botanic Garden Edinburgh. Additional specimen information was obtained via online resources from the Field Museum of Natural History Chicago, Harvard University, Royal Botanic Gardens Kew, University of Michigan, New York Botanical Garden and the Smithsonian Institution. Vegetation surveys in lowland savanna provided an additional 645 records (Goodwin *et al.,* 2013). This version of the database was used for a variety of project-related outputs, and to generate a checklist of vascular plants of the lowland savannas of Belize, which included 957 species names (Goodwin *et al.,* 2013). At handover (March 2015), the database contained 38,846 botanical records and 5,818 names. 1,620 of these names were recorded as 'accepted' in the taxonomic status field; 723 were recorded as synonyms, and the remainder were recorded either as 'excluded', or the taxonomic status field was blank.

A copy of all Belize vascular plant records was obtained from the herbarium at Missouri Botanical Garden in May 2015, with an update in early 2017. Additional records from databases at the Royal Botanic Garden Edinburgh (c. 2,000 records) and the Natural History Museum

London (c. 250 records) were added in 2016. A search through unmounted material at the Royal Botanic Garden Edinburgh (November 2016) yielded 70 new records. Data were transferred to the database using the rapid data entry tool. A user-defined matching process allows records already in the database to be updated with any new or additional information (e.g. geographic coordinates, revised species determinations). At this point the database contained c. 50,000 records.

An occurrence search via GBIF (specifying Tracheophyta, preserved specimens, and records with coordinates) returned 50,462 records. The GBIF data download (Darwin core archive format) puts collector name and number in the same field, whereas BRAHMS requires two separate fields. These fields are essential as a means of identifying records that are already in the database. A cross-check of 100 randomly selected GBIF records (held at institutions from which we had not directly obtained data) revealed that the records were duplicates of those held by herbaria from which we had directly obtained data. In light of this, and considering the time required to reformat the GBIF data to be compatible with BRAHMS, GBIF data were not added to the database.

The majority of records in the database are assumed to have been obtained via general collecting. Throughout this thesis, this term is used to refer to plant records that are not obtained within the confines of a measured plot, or via timed collecting, or via a systematic plotless method. Approximately 4,500 records were obtained via systematic sampling: data from four one-hectare permanent sample plots (trees & palms measuring => 5 cm DBH); data from 30 (500 m x 2 m) temporary transects (trees & palms measuring => 2 cm DBH); and data from 30 plotless Rapid Botanic Survey samples (whole flora). The permanent sample plots were established as part of two separate previous studies (Brewer & Webb, 2002; Brewer, 2014b). The temporary transects are part of an ongoing study, with some data published in *Brewer et al.,* 2003. For the permanent sample plots and temporary transects, species determinations were made either in situ by an experienced botanist, and/or voucher specimens were examined by taxonomists at Missouri Botanic Garden. Rapid Botanic Survey data was collected in 2016 as part of this D.Phil. research (see Appendix V). All plot data were added to the database via the BRAHMS 'plot samples' tool. Each record was then incorporated into the database as a 'plot voucher'. Given that some plot vouchers had already been deposited in herbaria, the database was checked for multiple copies of identical records and these were removed (plot-linked vouchers were retained).

A further 30 one-hectare permanent sample plots were established in Belize during the 1990s under the Forest Planning and Management Project (Bird, 1998). Five were re-measured as part of completed PhD research (Cho, 2013), and postdoctoral research (carried out under Darwin Initiative project number 21009 *'Biodiversity conservation through poverty alleviation: enabling sustainable forestry in Belize'* (Darwin Initiative, 2018b). During the first census, trees were identified (largely using vernacular names) by local forestry workers. Voucher specimens were not collected. A recent re-census of two plots has revealed numerous errors in species identification (pers. comm. Cho, 2015 and Brewer, 2016) and therefore these data were not included in the database. There are numerous other monitoring plots throughout Belize, set up for the purposes of timber and/or carbon stock inventories. In most cases, species determinations were carried out in the field by forestry workers and vouchers were not collected. Since the reliability of species determinations is not known, no attempt was made to obtain these plot data for inclusion in this version of the database.

Taxonomic status of names

The majority of botanical records in the database are voucher specimens held at the herbaria of Missouri Botanical Garden, where research and collecting in the Mesoamerican region has been ongoing since the 1920s. Species determinations therefore largely follow those listed at the Tropicos website (Tropicos, 2016), a publicly available database of nomenclatural, bibliographic and specimen data. It is assumed that these are the correct determinations, but it is acknowledged that misidentification, or recent taxonomic revision (not yet reflected on specimen labels) may mean this is not always the case.

Tropicos, where taxonomic circumscription follows APG (Angiosperm Phylogeny Group) III, was consulted to check the taxonomic status of all family and generic names. For species and infra-specific taxa, a 'name search' provides the user with a list of all publications that have accepted the name, a list of publications that have cited an alternative accepted name, and a list of publications that have cited synonyms of the name. For the purposes of this research, a name was automatically accepted if there were no references to literature that suggested an alternative accepted name. In cases where more than one accepted name was listed at Tropicos, priority was given to recent monographs or Flora accounts.

Synonyms were linked to the corresponding accepted names in the database. Invalid and illegitimate names were retained in the database but marked as 'excluded' with accompanying notes. Botanical records that had only been determined to family or genus were marked as 'vague'. All names were also cross-checked using The Plant List (The Plant List, 2016). At present, it is the most comprehensive data source for vascular plant names globally[7]. However, it has not been regularly edited or updated since data were first added in 2012 and does not reflect recently published taxonomic revisions. Taxonomic status of all names as listed by Balick (Balick *et al.,* 2000) were also recorded in the database to enable cross-checking for differences in opinion.

In cases where there were no botanical records attached to a name in the Belize database, Tropicos was consulted to determine the most recent publication that cited the species as being in Belize. If a botanical record was cited in a publication, the Belize database was searched to determine whether the record was stored under a different name. Records were updated as necessary. If the record was not already in the database, online herbarium databases were searched. If found, collection data for the record were added to the Belize database. If there was no citation for a specific botanical record in the literature, the name was excluded for the purposes of this research but retained in the database with accompanying notes (i.e. further investigation is required to determine if the species is present in Belize). On completion of name checks (December 2015), the list of accepted names remained static for the remainder of the D.Phil. research period.

The Belize dataset was used to generate a working checklist of the vascular plants of Belize (see Appendix II). This list was used to examine changes in numbers of taxonomic groups since Balick *et al's* checklist was published in 2000. Table 2.1 shows the number of families, genera, species and infra specific taxa in the Belize dataset compiled for this research, compared to those presented in Balick *et al.* To determine taxonomic bias, number of records per family were

[7] Ulloa *et al.,* (2017) published a checklist of the vascular plant species of the Americas after our name checking process was already complete. There was insufficient time available for additional cross-checking of names.

counted. Table 2.2 shows the top ten families ranked by number of records in the database. Table 2.3. shows the largest families (by genera) in the Belize vascular plant dataset, ranked by number of genera, compared with the dataset used by Balick *et al.*

Habit data

Tropical forest inventories often focus on tree taxa, leading to an absence of data for other habit types, e.g. epiphytes or herbs (Gentry & Dodson, 1987; Knapp, 2017). To examine whether there was a bias towards a particular habit type (and therefore to determine gaps in collecting effort) in the Belize dataset, species names were assigned to one of seven habit types. These data were transferred to a field in the main botanical records file (i.e. so that each individual record had a habit type recorded against it). Simple habit type definitions were deliberately chosen (i.e. definitions that would be easily understood and recognized by local land managers and field staff, many of whom have little or no experience of botanical collecting). These definitions were determined by consulting herbarium specimen labels, and/or by consulting species descriptions from various flora and checklists including Balick *et al.,* (2000), *Flora Guatemala* (Standley e*t al.,* 1946-1977), and *Flora Mesoamericana* (Davidse *et al.,* 1994-). Where there were discrepancies in the description of the habit type, the most-cited habit was chosen. Palms and ferns (although taxonomic groups rather than habit types) were separated out because (based on the authors experience of conducting inventories in Belize) field staff recognise them as being distinct. Definitions for each habit type are listed below.

Tree	Typically described as having a single woody stem (but some taxa repeatedly recorded as having two or more low-branching stems). This group includes taxa that are sometimes described as 'treelets' (a small tree), and 'shrubby trees' (a tree with multiple low-branching stems). This category includes woody, hemi-epiphytic 'tree' taxa but excludes large single-stemmed palms and tree ferns.

Shrub	Typically described as plants with multiple, low-branching, woody stems (i.e. does not usually form a single, woody stem), and often attaining a height (at maturity) of greater than 1 m.
Vine or liana	Plants that are typically described as having a climbing or twining habit. May or may not develop woody tissue. Excludes Araceae and ferns (see below).
Herb	This habit type includes all woody plants that are typically described as terrestrial and not regularly attaining a height of greater than 1 m. It also includes all ground-dwelling non-woody plants regardless of height at maturity (e.g. Zingiberaceae, Costaceae). Lycopodiaceae, aquatic herbs, Cycadaceae, succulents, saprophytic and non-epiphytic parasitic plants are also included in this category.
Palm	All taxa in the Arecaceae.
Epiphyte	This category includes all non-woody taxa that are typically described as growing attached to other plants (usually trees), or rocks. In many cases, taxa within Araceae were often described as vines or epiphytes. For the purposes of this study, all Araceae were placed in the 'epiphyte' habit group unless they had been repeatedly recorded as 'terrestrial', in which case they were placed in the 'herb' group. This group also includes the majority of Orchidaceae and Bromeliaceae in Belize, and epiphytic parasitic plants.
Fern	May be terrestrial, epiphytic, or forming large single stems.

Table 2.4 shows the number of botanical records in the database for each of the habit types. The iNEXT package (Hsiech *et al.,* 2016) for R (R Core Team, 2017) uses the Chao1 equation to calculate estimates of species richness from individual-based data (i.e. botanical records). It was selected because it accounts for undersampling bias, and because the results are intuitive in terms of exploring the data available for this research. The iNEXT package was used to calculate estimates of species richness for the whole flora (Figure 2.1), and for the seven

different habit groups (Figure 2.2 and Table 2.5)., using a total of 46,300 botanical records (all those with a determination to species) from the Belize database.

Locality data

All georeferenced botanical records were mapped in ArcMap (version 10.4.1) to check for obvious errors in georeferencing. Most errors were corrected by cross-checking locality data from specimen labels. Approximately 6,000 botanical records in the database had no coordinates attached at the time of handover. Locality text from specimen labels was used to search for corresponding coordinates via Google Maps. Where place names could not be located using Google Maps, a set of Ordinance Survey topographic maps (Crown Copyright, 1993) were manually searched for place names. These were particularly useful in terms of finding names that referred to old logging camps, and names of settlements that have since changed. In some cases, coordinates from the label did not correspond with the locality text. These errors were addressed using Google Maps or the topographic maps. In all cases where coordinates were added or changed, a note was kept against each record in the database. As of 27 April 2018, approximately 3,000 records remained without coordinates. In most cases, only a district was listed on the label and therefore it was impossible to determine a more precise location. Similarly problematic are specimens that cited a road or river name with no further information indicating distance to a named place, road, or landmark.

Existing shapefiles for roads, settlements and protected areas (downloaded from http://www.biodiversity.bz/) were used to examine the distribution of records across Belize and to detect spatial bias (Figure 2.3). Sampling effort (number of botanical records) was calculated per 5km^2 using georeferenced records from the Belize database (Figure 2.4). To obtain data on collecting within and outside of protected areas, botanical records were linked to the corresponding protected area polygon based on spatial data. Table 2.6 shows the top ten protected areas ranked by number of botanical records per km^2.

Geological data

Spatial bias in the dataset was investigated to determine whether it resulted in bias towards collecting on a particular geological substrate. Geological data were obtained from Cornec's (1986) geological map of Belize, revised to reflect the map shown in Bridgewater (2012). The revised version shows six major geological substrata (see Chapter 1). Botanical records were joined to the corresponding geological polygon (using tools in ArcMap) based on spatial data. Those data were transferred to the botanical records file in the Belize database (so that each botanical record was assigned to one of the six geological substrata). Table 2.7 shows the number of botanical records for each of the six geological substrata. The iNEXT package (Hsiech *et al.,* 2016) was used to calculate estimates of species richness for each substrate. Figure 2.5 shows the individual-based species accumulation (rarefaction & extrapolation) curve for each of the six geological substrata. Table 2.8 shows the observed and estimated species richness (with upper and lower confidence limits) generated by the Chao1 equation in iNEXT.

2.3 Results

Taxonomic groups

On 1 May 2018, the Belize vascular plant database contained 54,135 botanical records, of which 85% are stored under an accepted name. A total of 3,941 accepted names were recognized. This figure included infra-specific taxa, which were counted as separate entities (e.g. a species with two varieties was counted as three taxa). The database contained 1,480 synonyms. Accepted names included species, infra-specific taxa and cultivated taxa. Table 2.1 shows the number of taxa for each taxonomic rank compared to those listed by Balick *et al*., (2000). This study recognises an additional 21 families, 168 genera, 196 species, and 208 infra-specific taxa.

There were 326 accepted names with no botanical records attached in the database. Either no voucher specimen was cited in literature, or a specimen was cited but was not located via a search of online herbaria and other databases. These names require further investigation and were excluded from any analyses.

Table 2.1 Number of families, genera, species and infra specific taxa compared to Balick *et al.,* (2000).

	Stott (2019)	Balick (2000)
Families	230	209
Genera	1,387	1,219
Species	3,604	3,408
Infraspecific taxa	243	35

Table 2.2 shows the top 10 families ranked by number of botanical records in the database. Approximately 8% of records in the database were stored under a 'vague' name (a determination only to family or generic level, or no determination at all). Of the 10 most-collected families, Poaceae had the highest percentage of indets (8.3%) followed by Fabaceae *s.l.* (7.3%).

Table 2.2 Top ten families ranked by number of records in the database.

Family	No. of records	% of records
Fabaceae *s.l.*	4,908	9.1%
Rubiaceae	3,440	6.4%
Poaceae	2,113	3.9%
Melastomataceae	1,940	3.6%
Asteraceae	1,900	3.5%
Cyperaceae	1,870	3.5%
Malvaceae *s.l.*	1,433	2.6%
Arecaceae	1,422	2.6%
Apocynaceae	1,362	2.5%
Euphorbiaceae	1,325	2.4%

Table 2.3 shows the top ten largest families in the database ranked by number of genera, presented alongside data from Balick *et al.*, (2000). The dataset suggested Orchidaceae as the largest family with an increase of nine genera and 11 species. The largest increase in both genera and species was seen in Fabaceae *s.l.* with this study recognising an additional 16 genera and 98 species.

Table 2.3. Largest families (by genera) in the Belize vascular plant database ranked by number of genera, compared with data from Balick *et al.,* (2000).

Stott, 2018			Balick *et al.,* 2000		
Family	Genera	Species	Family	Genera	Species
Orchidaceae	102	290	Fabaceae *s.l.*	80	295
Asteraceae	95	178	Orchidaceae	93	279
Fabaceae *s.l.*	96	393	Poaceae	74	248
Poaceae	82	291	Asteraceae	86	153
Rubiaceae	63	177	Cyperaceae	21	146
Malvaceae *s.l.*[8]	45	109	Rubiaceae	50	142
Apocynaceae	36	74	Euphorbiaceae	31	104
Euphorbiaceae	31	119	Melastomataceae	20	96
Arecaceae	26	55	Myrtaceae	10	58
Bignoniaceae	26	42	Aspleniaceae	17	58

Estimated species richness for the flora of Belize

Figure 2.1 shows an individual-based species accumulation curve for the flora of Belize, generated using the iNEXT package in R. Species richness for the flora of Belize was estimated to be 4,746 (lower 95% confidence level of 4,617, upper 95% confidence level of 4,899). These results suggest that 83% of estimated species richness for Belize has already been documented.

Estimated species richness for habit types

Tree taxa accounted for the largest number of botanical records in the database (c. 33% of all records). Table 2.4 shows number of records for all habit types. A total of 3,827 records in the database had not been determined to species and therefore were excluded from the calculations.

[8] In Balick *et al.,* (2000), Malvaceae, Tiliace, Sterculiaceae and Bombacaceae were treated as separate families.

Figure 2.1. Individual-based species accumulation (rarefaction & extrapolation) curve for the flora of Belize. Number of individuals (botanical records) are plotted against number of species. The Chao 1 equation (Chao, 1984) is used to estimate asymptotic species richness.

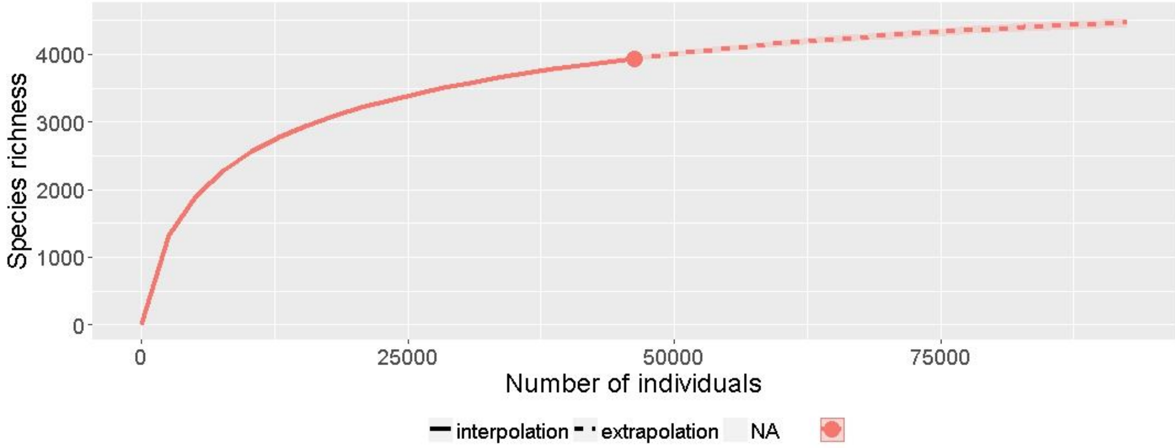
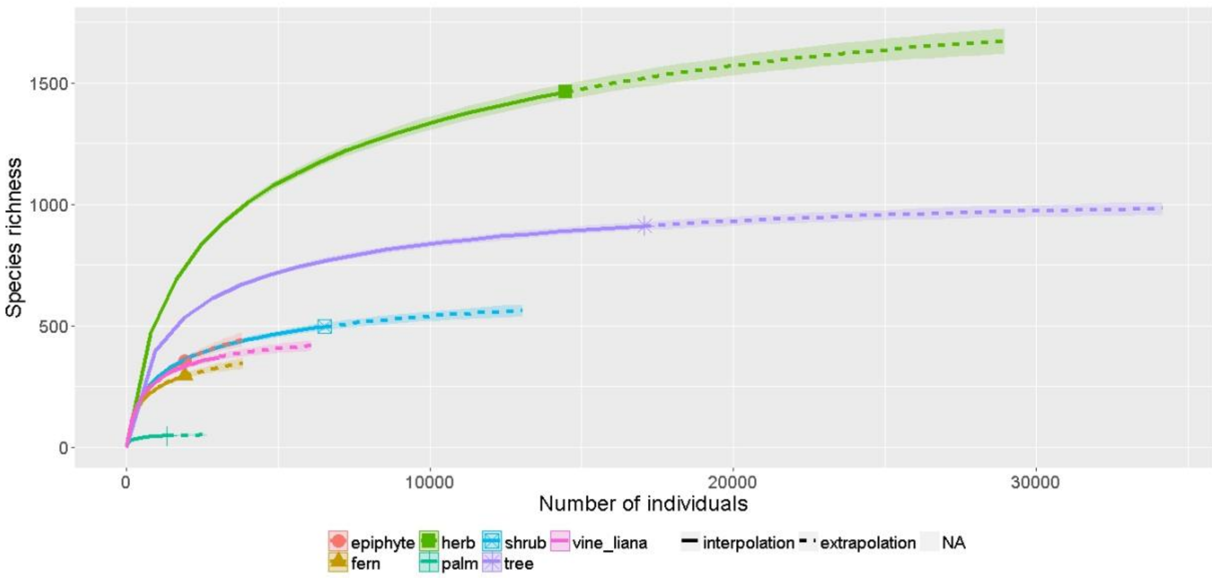


Table 2.4. Number of botanical records in the database for each of the growth habit types.

Habit type	Records	Percentage
Epiphyte	2,155	4%
Fern	2,124	4%
Herb	16,006	30%
Palm	1,414	3%
Shrub	7,113	13%
Tree	17,986	33%
Vine or Liana	3,510	6%

Figure 2.2. Individual-based species accumulation (rarefaction & extrapolation) curves for each habit type. Number of individuals (botanical records) are plotted against number of species. The Chao1 equation (Chao, 1984) is used to estimate asymptotic species richness.



Results (Table 2.5) indicated that the species inventory is incomplete for all seven habit types. Palm taxa were closest to sampling completeness with 91% of estimated species richness already documented. The status of tree taxa was similar, with 90% of estimated species richness already collected and identified. Herbs were estimated to have the highest species richness, with 82% of estimated species richness already documented. Epiphytes were the least well-documented, with only 69% of estimated species richness already collected and identified.

Table 2.5. Observed and estimated species richness for each habit type (LCL=lower confidence level; UCL=upper confidence level), generated using the Chao1 equation.

	Observed	Estimated	LCL	UCL	% complete
Tree	912	1,008	974	1,063	90
Herb	1,464	1,777	1,701	1,877	82
Epiphyte	355	516	456	610	69
Fern	294	379	341	446	78
Shrub	497	596	558	658	83
Palm	47	51	48	72	91
Vine or liana	372	438	409	489	85

Distribution of botanical records

The distribution of records across Belize showed clear patterns in relation to major roads, and clusters of collections around some settlements (Figure 2.3). The distribution of records was not even, with fewer records in the northern half of the country. Figure 2.4 shows sampling effort (number of records) per 5 km grid cell across Belize. The total number of grid squares with ≥ 1 record was 687. The maximum number of records per 5 km grid cell was 5,258, and the mean was 68. Of the 687 grid cells with at least one record, 43% had less than 10 records.

Several areas with high numbers of records corresponded to research stations. Las Cuevas is a research station in the Chiquibul Forest Reserve where the Natural History Museum London ran a research programme from 1994 - 2004. The Belize Foundation for Research and Environmental Education (BFREE) is a private protected area with research, education and tourist facilities. Since its establishment in 1995, BFREE has had the benefit of a staff botanist. Areas where there are distinctive geomorphological features also have relatively high numbers of records per unit area. There have been at least five major expeditions to Doyle's Delight, the highest point in Belize, several of which involved botanists (Meerman & Matola, 2007). Little Quartz Ridge, towards the southwest of the country, was the site of a Rapid Environmental Assessment in 1997 (Meerman & Matola, 1997), and was also included in a biological assessment of the Columbia River Forest Reserve (Parker *et al.,* 1993).

Over half (28,403) of the records in the database were collected in areas that currently have protected status, yet protected areas cover only c. 36% of the country. Table 2.6 shows the top ten protected areas ranked by number of botanical records per km^2. Bladen Nature Reserve (BNR) had the highest number of botanical records for any of Belize's protected areas. This figure equates to 22 records per km^2. BFREE (a private protected area) had the highest number of records with 30 per km^2, followed by Fireburn (also a private protected area) with 23 records per km^2.

Table 2.6. Top ten protected areas ranked by number of botanical records per km^2.

Protected Area	Area (km^2)	Number of records	% of all records in database	Records per 1 km^2
BFREE	5.72	171	0.32	30
Fireburn	7.45	175	0.32	23
Bladen Nature Reserve	404.11	9073	16.76	22
Victoria Peak National Park	19.58	360	0.67	18
El Pilar	7.69	116	0.21	15
Belize Zoo Trust	6.97	83	0.15	12
Cockscomb Basin Wildlife Sanctuary	494.78	3923	7.25	8
Golden Stream Corridor Preserve	60.85	379	0.70	6
Nojkaaxmeen Eligio Panti	51.54	315	0.58	6
Runaway Creek	23.84	111	0.21	5

Figure 2.3. The distribution of georeferenced botanical records in the database in relation to major roads and settlements. Data (shapefiles) for roads and settlements obtained from the BERDS website (Meerman & Clabaugh, 2017). Settlements are defined as cities, towns, villages and communities, and point locations are based on information from the National Association of Village Councils of Belize.

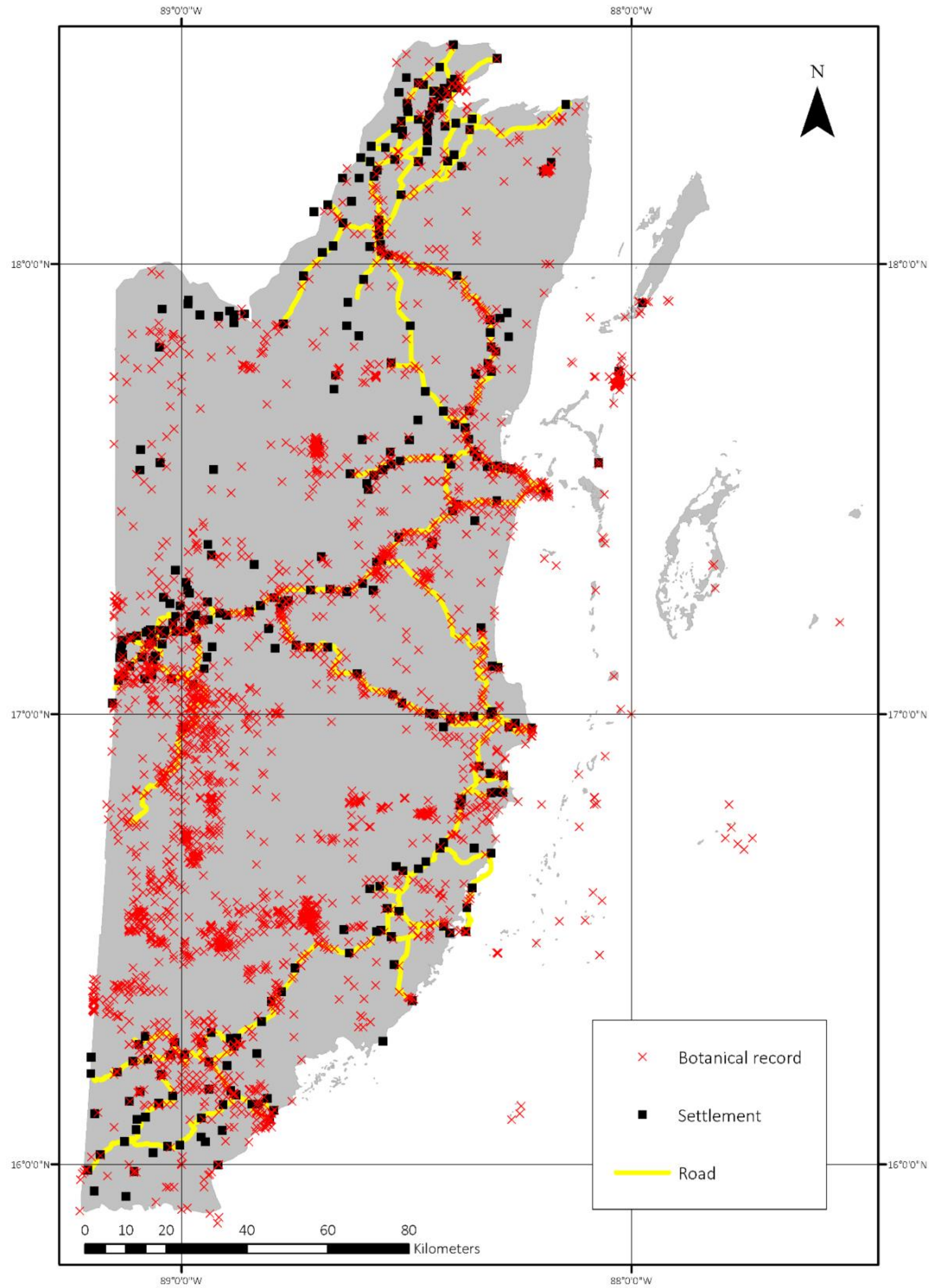
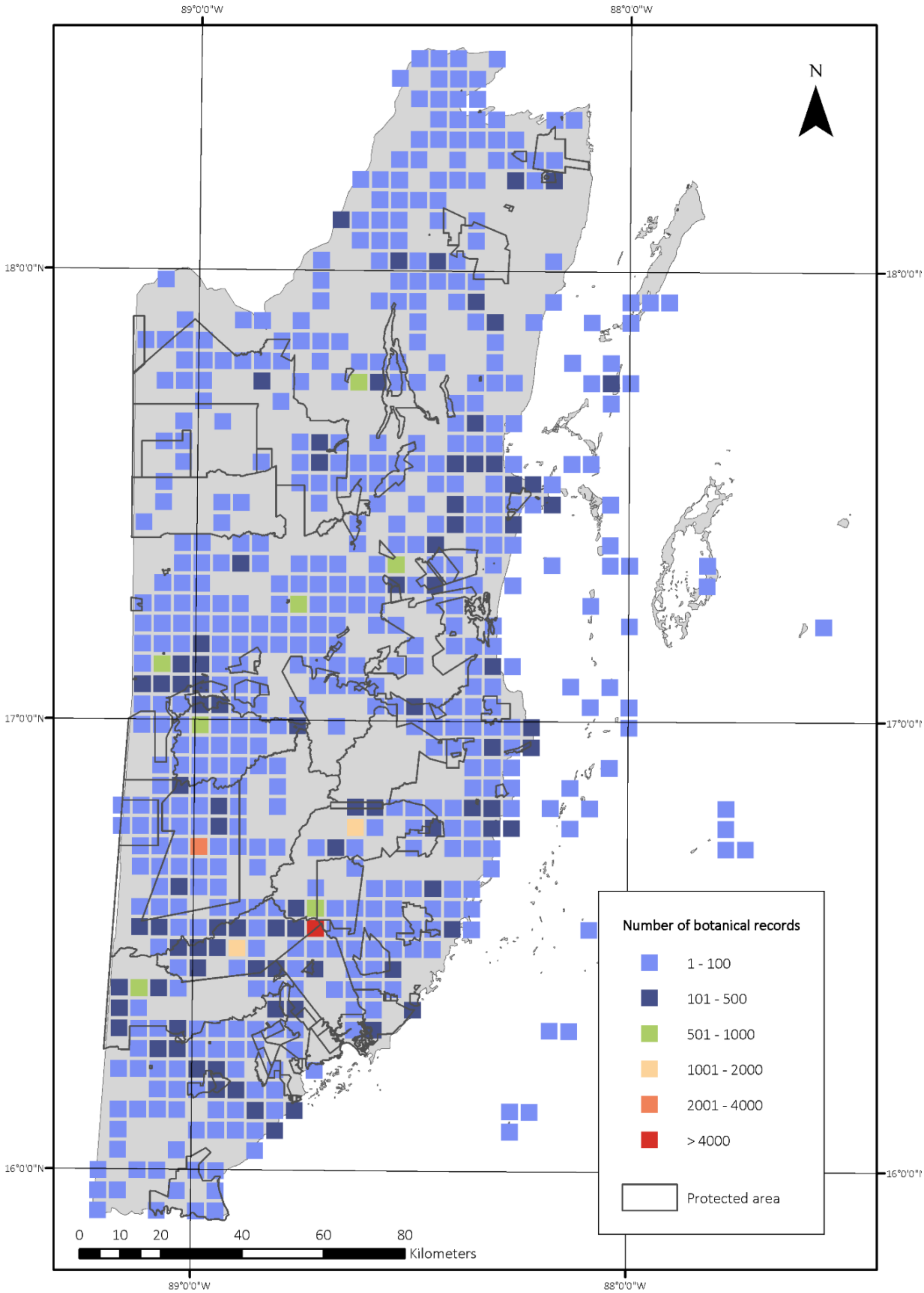


Figure 2.4. Sampling effort (number of botanical records per 5 km grid cell) across Belize, shown in relation to the national protected area system. Colours in legend relate to number of botanical records per cell. Areas with no cells indicate no botanical records.



Estimated species richness for geological substrata

Table 2.7 shows the number of records collected on each of the six major geological substrata found across Belize. Limestone had the highest number of records and covers the largest surface area. However, a total of 20,188 records equates to only two records per km^2, indicating that limestone, together with the calcareous sandstones & shales, and the recent alluvial & littoral sediments, are the least collected relative to total surface area. The volcanic substrate had the highest number of records per unit area (8 per km^2).

Table 2.7. Number of botanical records for each of the 6 major geological substrata in Belize.

Geological substrata	Total number of records	% of all records	Area (km^2)	% of total landmass	Records per km^2
Acid sandstones, shales & slates	7,660	16	3,056.35	14.02	3
Calcareous sandstones & shales	2,852	6	1,469.92	6.74	2
Granite	4,889	10	789.96	3.62	6
Limestone	20,188	42	10,075.48	46.22	2
Recent alluvial & littoral sediments	10,573	22	6,145.22	28.19	2
Volcanic	2,063	4	262.01	1.20	8

Figure 2.5 shows individual-based species accumulation curves for each of the six geological substrata in Belize. Results indicated that none of the substrata have reached sampling completeness. Limestone was the closest with 76% of estimated species richness having already been documented and is likely to support the highest species richness according to the Chao1 estimates shown in Table 2.8. The recent alluvial & littoral sediments had the second highest species richness and, along with acid sandstones, shales & slates, had 73% of estimated species richness already collected and identified. The volcanic substrate was estimated to have the lowest species richness. Despite having the highest number of records per unit area, only 62% of its estimated species richness has already been documented.

Figure 2.5. Individual-based species accumulation curves for each of the six main geological substrata in Belize (acid = acid sandstones, shales & slates; calc = calcareous sandstones & shales; gran = granite; lime = limestone; rece = recent alluvial & littoral sediments; volc = volcanic). Number of individuals (botanical records from the Belize vascular plant database) are plotted against number of species using the Chao1 equation to estimate asymptotic species richness.

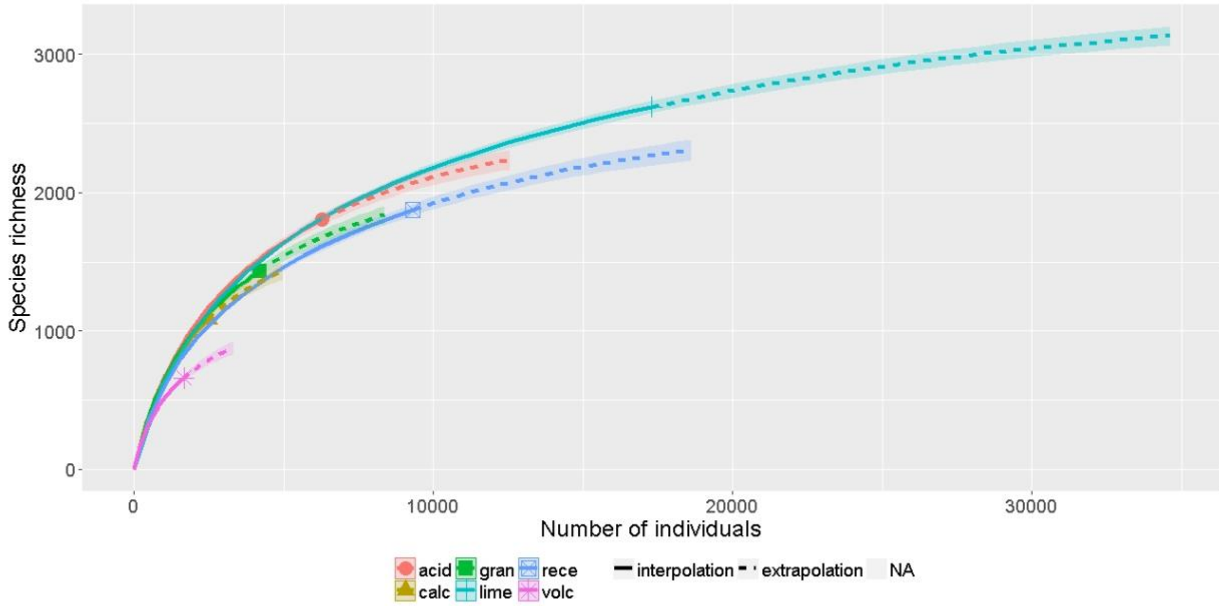


Table 2.8. Observed and estimated species richness (LCL is lower confidence limit; UCL is upper confidence limit) for each of the six major geological substrata in Belize, generated using the Chao1 equation.

	Observed	Estimated	LCL	UCL	% complete
Acid sandstones, shales & slates	1,805	2,463	2,346	2,604	73
Calcareous sandstones & shales	1,084	1,657	1,541	1,802	65
Granite	1,434	2,109	1,981	2,267	68
Limestone	2,620	3,438	3,301	3,602	76
Recent alluvial & littoral sediments	1,875	2,574	1,071	2,728	73
Volcanic	660	1,062	959	1,201	62

2.4 Discussion

Overall, these results suggest that the flora of Belize is reasonably well-documented but also clearly demonstrate bias in the Belize dataset. Although bias in the data is a ‘warning flag’ in terms of using the results to directly assign conservation priorities based on species richness or diversity, this assessment is useful with regard to determining research priorities (e.g. under-collected taxa, or geographic areas), and for indicating major trends. Trends should be interpreted with some caution, given the limitations of treating herbarium data with the Chao1 equation. Herbarium data are non-random, and both over-dispersed and clustered at different spatial scales. In addition, a species may not be acceded further in a collection once there are sufficient vouchers for it to be considered common (i.e. numbers of records for that species are curtailed). This could have the effect of making sampling look less complete than it actually is.

Tree taxa account for the largest proportion of records in the database and results suggested that this group is nearing sampling completeness. This is likely due to the inclusion of plot data, and data for 30 temporary transects where (in both cases) trees were the focal taxa. Plot data are also likely to result in more accurate Chao1 estimates. If similarly reliable data (i.e. species determinations supported by voucher specimens) were available for the other 30 one-hectare plots, this would provide a substantial boost towards completing the inventory of Belize's tree flora. The focus on tree taxa (i.e. greater sampling effort) is common for the tropics *(Prance et al.,* 2000b; Garrett, 2017; Knapp, 2017) and the results presented here suggest that Belize is no exception. The dataset suggests that epiphytes are under-represented relative to other habit types. This is unsurprising given the difficulty associated with collecting. An epiphyte inventory (a collaboration between Caves Branch Botanical Garden in Belize and Marie Selby Botanical Garden in the USA) is ongoing (started in 2014) but those data are not yet available for inclusion in the database.

It is somewhat surprising to see Rubiaceae as the second-most collected family in Belize given its reputation as being difficult to identify, particularly with sterile material. However, only 4.8% of these records have not been identified to species level, indicating that Rubiaceae are relatively well known for Belize. This has no doubt been facilitated by completion of the Rubiaceae section of *Flora Mesoamericana* (Davidse *et al.,* 2012).

Balick *at al.,* (2000) examined material deposited at New York Botanical Garden, and to a lesser extent, Missouri Botanical Garden and 'other herbaria' (not specified) and examined approximately 17,000 herbarium specimens. As for this research, they considered a name as 'suspect' (unconfirmed) until a corresponding voucher specimen, or at the very least, a literature citation could be found. The fact that many herbaria now have at least some of their specimen data online makes the process of compiling a checklist significantly easier (although perhaps now a more daunting task) as it provides instant access to a much larger pool of material. Increases (or, less often, decreases) in number of genera and/or species are certainly due in part to easier access to material but also result from changes in taxonomic circumscription, or differences in the names this D.Phil. research recognised as accepted. The Belize database concurs with 90% of names that Balick *et al.* accepted. The remainder are treated as synonyms or are excluded from this study because they are invalid or illegitimate names. For Belize, it would seem that increases in numbers of genera and species have occurred because of easier access to a greater amount of data, rather than a significant increase in botanical collecting, given that only c. 9,200 records (this figure excludes plot vouchers in the database that are not herbarium specimens) were recorded as being collected between 2000 (publication date for Balick's checklist) and 2017.

Collecting is unevenly distributed across the country, with a definite bias towards collecting along some of the major roads (with the exception of the Southern Highway, which was only completed in 2009). The north east appears less well-collected than other parts of the country, despite the presence of several private reserves, most of which are currently under logging concessions. Timber and/or carbon stock assessments have been completed in some of these areas and so there is likely to be more data available for the tree flora (certainly for commercially valuable species) than the database suggests. Land use change and associated forest loss is altering the landscape of northern Belize.[9] Several areas that appear sparsely collected are now under commercial-scale agriculture. If resources for in situ surveys are limited, they are perhaps better utilised to document plant diversity in the central and southern part of the country, where the broadleaf forests of the Maya Mountains form one of the last remaining relatively intact blocks of forest in the Mesoamerican biodiversity hotspot (Briggs *et al.,* 2013).

Examination of collecting effort across the country clearly demonstrates that higher numbers of records have been collected near research stations and settlements. Distinctive geomorphological features are often the subject of expeditions and it is no surprise to find a

9 According to Cherrington *et al.,* (2010), Corozal and Orange Walk (both in the north of Belize) had the highest and second highest average annual decline of forest cover between 1980 and 2010. Corozal had an average annual decline of 0.9%. Orange Walk had an average annual decline of 0.7%. The lowest average decline (0.4%) was seen on the offshore Cayes. Although admininstered under various Disctricts, the offshore Cayes were treated as a separate entity for the analysis.

higher density of records at these locations. While the area around Las Cuevas appears to be well documented, there are issues with imprecise localization of botanical records. Examination of locality text on specimen labels revealed that some of these records were indeed collected in the immediate vicinity of the research station, while others represent coverage across a much wider area. The remainder of the Chiquibul National Park (which includes Chiquibul Forest Reserve, see map of protected areas in Chapter 1, and list of protected areas in Appendix I) is, by comparison, under-collected. It is the largest protected area in Belize at c. 1,666 km^2. Despite being the protected area with the second highest number of botanical records (5,758), this equates to only four records per km^2. The area around the Belize Foundation for Research and Environmental Education (BFREE) has a high density of records (30 records per km^2) due to the presence of four one-hectare permanent sample plots, and collections within the grounds of the research station itself.

The distribution of botanical records suggests that, ideally, the focus of collecting should move away from well-documented areas to provide a more even coverage of the country. More collecting in protected areas (but away from research stations) should be encouraged, so that data can be provided to managers. Unfortunately, de-reservation of protected land (usually of small parcels of land on the edges of protected areas) does occur in Belize. Protected area managers need to be well armed, with robust, reliably-sourced biodiversity and ecological data, if they are to present a convincing case against the threat of land use change. As a starting point, the Belize dataset could be used to generate species lists and species richness estimates for land managers, helping to guide the direction of botanical research and monitoring for incorporation into management plans.

The noticeable gap in collections towards the centre of the country, which has so far reached only 73% of estimated species richness, corresponds to an area of acid sandstones, shales & slates (see Chapter 1, Figure 1.2). This area corresponds to an elevational gradient ranging from approximately 0 - 1000 m. Most of the collections on this substrate are towards the west of the country, at higher elevations. It is possible that the elevational gradient, and corresponding differences in temperature have created a diverse range of habitats which may result in high species richness. Surveys should aim to achieve a more even distribution of collections across this substrate. The complex topography of limestone (particularly towards the southwest of the country), in combination with the north - south rainfall gradient (limestone is found in patches along almost the entire length of the country), and variation in elevation (approximately 0 - 900 m) may also provide diverse habitats that would support the estimated high species richness (Hortal *et al.,* 2009; Lippok *et al.,* 2014) relative to the other geological substrata. Although the volcanic substrate has the lowest estimated species richness it covers a relatively small area. Completing the floristic inventory of this substrate would be more feasible than for other substrates. The relatively high estimated species richness of the recent alluvial & littoral sediments (where there is little variation in topography) is likely to be associated with disturbance (from hurricanes, subsequent wildfires, and past land use) resulting in high species turnover. The influence of underlying geology and associated topographic complexity is explored further in Chapter 3 in relation to the presence of globally rare species and bioquality hotspots.

The Belize database is likely to be the most comprehensive (in terms of records, and distribution data) currently available for the country. It will continue to be a valuable resource if regularly updated in line with new collections and subsequent changes in distribution data, as well as recent taxonomic revisions that lead to changes in species determinations. At its current size, this would be relatively easy to achieve and ideally should be the responsibility of a research institute in Belize (discussed in Chapter 6).

The level of misidentification, or misapplied names, present in the Belize database is not fully known and therefore the degree to which it might affect the results of any of the analyses conducted for this thesis has not been estimated. It would be wise for anyone extracting small subsets of records from this database for use in other studies to make every effort to check for errors by examining specimens in person or online where available. Misapplied names (or errors in identification) on collected material is potentially problematic across a broad range of research areas and can ultimately only be tackled by accelerating the pace of taxonomic work in herbaria.

CHAPTER 3

The distribution of bioquality in relation to geological and topographic diversity

3.1 Introduction

Limited funding for biodiversity conservation often restricts what can be done on the ground, particularly in low-income tropical countries (Gordon & Newton, 2006). There is a need to make strategic, pragmatic decisions regarding the distribution of resources to plan and implement any kind of action. The practice of 'ecological triage' (Hobbs & Kristjanson, 2003) has become commonplace, whereby the most 'serious cases' are prioritized for treatment. How do we decide what and where these serious cases are? First, it is necessary to quantify 'conservation value'. This can be approached in several ways. Species richness and species diversity have been widely used as measures of conservation value (e.g. Baden *et al*., 2016; Cascante-Marín & Nivia-Ruíz, 2013; Gentry, 1986). Areas where there are high concentrations of endemic species have also been put forward as priorities for conservation. Endemism can be viewed as a basis for a measure of conservation value based on irreplaceability. For example, if two areas of similar size and species diversity are compared, and one contains a higher proportion of species that have small global ranges, then that area is considered a conservation priority. Its degradation or destruction represents a greater loss to global biodiversity because the species within it are restricted to that area and therefore in greater need of conservation measures (Brooks *et al.,* 2006).

A simple and practical measure of conservation value that focuses on range-restricted global endemism is the assessment of 'bioquality', carried out within the Rapid Botanic Survey (RBS) framework (Hawthorne & Abu-Juam, 1995; Hawthorne, 1996). Bioquality is a measure of biodiversity that places emphasis on taxa that are globally rare (those with a very restricted geographic or ecological range). It does not place emphasis on species of cultural importance, species that are commercially valuable, or species that may have a socio-economic value. RBS encompasses a suite of field and desk-based activities and can incorporate data from various sources (e.g. voucher specimens from herbaria, or data from permanent sample plots). These data can then be used to infer patterns in the distribution of 'bioquality hotspots' (areas where there are high concentrations of globally rare species).

Bioquality is measured using a standardised index, the Genetic Heat Index (GHI), so called because taxa that represent scarce genetic resources (globally rare taxa) are more highly valued in the context of conservation. First, taxa from the area of interest are assigned to one of four colour-coded categories ('Stars'). A Black Star is a species that is globally rare (a high-level conservation priority), followed by Gold and Blue. A species placed in the Green Star category is globally widespread (a low-level conservation priority). The mean geographic range of the species for each Star has been set to a standard value (see Table 3.1) and regional Star frameworks are developed to align with these mean values as closely as possible. Geographic ranges of species in a given area follow a continuous and canonical statistical distribution (Preston, 1962), but the mean geographic range of each Star is set so that each has a mean observed (i.e. not modelled) range three times smaller than that of the next rarest Star, at the resolution of one-degree square in the tropics. Hence, species placed in the Black Star category will, on average, occupy three times fewer degree squares than a species placed in the Gold Star category.

Within the RBS framework, the standard format with which to express the global rarity of a species (for tropical and sub-tropical regions) is to use degree square counts (for extra-tropical species, a 100 km grid is used). A longitude-latitude degree square grid is placed over a world map, and the global range of a species is plotted using coordinates from occurrence records to create a dot map (examples are shown in Appendix III). The number of squares occupied by a species throughout its range are counted, and the total denotes which Star category it should be placed into. Fine-tuning the Star category may be necessary for some taxa and guidance for doing so is incorporated into the regional Star framework (see Table 3.1). Mean ranges for each Star category are continuously checked as new taxa are added to that category. Stars can also be assigned based on known biogeography as reported in national or regional flora or checklists (e.g. 'endemic to the lowland savannas of Belize').

A weight is applied to each Star that is inversely related to the global range (27:9:3:0) to enable the calculation of GHI for a plant community or, more usually, a representative subsample of a community (e.g. a sample plot). A full explanation of the RBS framework and associated activities can be found in Hawthorne & Marshall (2015). Table 3.2 shows a sample calculation of GHI. Table 3.3 shows weights and ideal mean ranges of Stars.

Unlike the IUCN Red List assessment process, RBS Star categories do not consider historical reduction in population size or decline in extent of occurrence or area of occupancy. This helps to maintain simplicity in the bioquality index and means that categorising species into Stars is relatively quick. For example, 100% of tropical African plant taxa (40,401 names) have a Star rating whereas only 8% have been assessed using IUCN Red List criteria (Marshall *et al.,* 2016). Assigning species to Stars is very useful in its own right and can also serve as a means to prioritise species (Black Star taxa) that are most in need of a full IUCN Red List assessment.

The GHI, being a weighted average, can be calculated and compared meaningfully at multiple scales. The RBS framework has most recently been used to define hotspots across tropical Africa (Marshall *et al.,* 2016), and previously to guide national scale conservation priorities in Ghana (Hawthorne *et al.,* 2012) and Trinidad & Tobago (Baksh-Comeau *et al.,* 2016), and to inform 'within landscape' conservation priorities in seasonally dry tropical forests in Oaxaca (Mexico) & southern Honduras (Gordon *et al.,* 2004). Since bioquality can vary over short distances, a matter of meters (Hawthorne & Marshall, 2015), the RBS framework is well-suited for guiding local-scale on-the-ground land management. This was the primary reason it was selected for this research. The system is an appealing option for land and biodiversity managers because species can be categorised into Stars relatively rapidly and then preliminary GHI scores can be calculated from existing data (e.g. herbarium specimen databases).

Improving our understanding of how bioquality changes in response to environmental factors could potentially accelerate the discovery of previously unknown hotspots. Although abiotic variables that directly affect the survival of plants (such as availability of soil nutrients, or moisture) will directly influence distribution patterns, these data are scarce or poorly resolved for many parts of the tropics. In contrast, data for indirect variables such as regional climatic patterns, geology and elevation are widely available. Previous research suggests that topographic complexity positively influences species richness & diversity because the diversity of habitats is increased (Hortal *et al.*, 2009; Lippok *et al.*, 2014). A topographic gradient for example (e.g. ridge - slope - flat), creates a gradient of soil moisture and/or nutrient availability, thereby providing ecological niches for different species. Different topographic positions are also subject to different disturbance events. For example, ridgetop habitats may experience stronger winds; steep slopes are subject to landslides & erosion (Webb *et al.,* 1999). These factors are likely to have an influence on the species that can persist in these habitats. In addition, greater heterogeneity of habitats may provide more opportunities for speciation (Severin *et al.,* 2015), and endemism is reported to be concentrated in isolated patches of unusual habitat (Gentry, 1992). As the source material for the formation of soils, variation in underlying geology (in combination with topographic complexity) has been shown to contribute to diverse plant communities (Takyu *et al.,* 2002). Studies of changes in plant community composition along elevational gradients indicate that species richness and species composition change across different groups of plants (Kessler, 2000; Willinghöfer *et al.,* 2012) and this is likely due to the different ecophysiological adaptations of each group.

Objectives

To examine patterns in bioquality across Belize, and to determine whether these patterns relate to geological and/or topographic diversity.

3.2 Materials and methods

Data for the analyses carried out in this chapter were extracted from the Belize vascular plant database. Methods for population and curation of the database are documented in Chapter 2.

Assigning species to Stars

Each accepted name (species and infra specific taxa) was assigned to the relevant Star based on the number of global degree squares occupied. Star ratings (see examples in Appendix III) followed the guidelines that a Black Star should occupy a mean of 2.66 degree squares, a Gold Star should occupy a mean of eight degrees squares, a Blue Star should occupy a mean of 24 degree squares, and a Green Star species should occupy a mean of 72 degree squares (Hawthorne & Marshall, 2015). Degree square counts were based on existing occurrence data (not predicted range, or range estimates). Star ratings for a total of 1,919 species (1,871 Green, 47 Blue, and 1 Gold) were imported from an existing database file (provided by William Hawthorne, compiled from previous RBS work; Star categories for species updated in 2014). Distribution data for the remaining species were collated from the Tropicos (Tropicos, 2018) website (which lists specimens, as well as literature that relates to distribution), the Global Biodiversity Information Facility (GBIF, 2016), via an occurrence search for each accepted name, and from *Flora Mesoamericana* (Davidse *et al.,* 1994-). A list of countries was entered into the 'global range' field of the Belize database for each accepted name. To speed up data entry, each country was assigned a unique 3-letter code. Species with a widespread global range (e.g. occurring throughout Mexico, Central America, and South America) were automatically placed in the Green Star category. Species occurring only in Belize were initially placed into the Black Star category, but with further refinement as detailed below. A preliminary Star rating was assigned to all other taxa based on a visual examination of georeferenced records held at GBIF. Georeferenced records for all accepted names were then downloaded from GBIF. All potential Black Stars were mapped in ArcMap and degree squares counted. Ten percent of potential Green Stars were mapped, and degree squares counted. Degree square counts were carried out for all remaining species to determine whether the species should be assigned a Gold or Blue Star rating. Infraspecific taxa were provisionally assigned the same Star as the mother species. Locally rare infraspecific taxa were later upgraded as necessary (i.e. those with a more restricted range than the mother species).

On completion of degree square counts, the mean count for each Star category was checked and adjustments were made as necessary (i.e. downgrading a borderline BU Star to GN). For some species, further refinement was required. If a limited number of georeferenced records were available but associated literature suggested a wider range, extra degree squares were added to the count as necessary. On completion of this process, Star ratings remained static for the duration of this research. Minor revisions should be expected in future in response to new collections data, and/or taxonomic revision which may lead to an expansion or contraction in the global range of a species. Figure 3.1 shows number of taxa per Star, and Table 3.4 shows a breakdown of Stars per habit type (for details of habit types, see Chapter 2).

Preliminary bioquality map

To produce a preliminary bioquality map for Belize, GHI scores were generated from within the Belize database using BRAHMS tools. The 'diversity analysis' tool classifies georeferenced botanical record into cells of a specified size and uses those data to calculate GHI (see Table 3.2 for sample GHI calculation). A 5 km grid cell size was selected (a resolution suitable for local - landscape scale conservation planning) and GHI was calculated using all georeferenced botanical records (for species and infra specific taxa) but excluding cultivated taxa. The aim was to generate a dataset that would strike a balance between having sufficient samples (GHI scores) to allow for meaningful analyses of distribution patterns, and having GHI scores that were reasonably reliable (i.e. sufficiently sampled grid cells). Three datasets were compared, each having a different threshold for minimum number of records. Summary statistics were calculated for each dataset, and a Pearson's product moment test was used to determine if there was a relationship between GHI and number of records per grid square. Results are shown in Table 3.5.

GHI scores from the selected dataset were mapped and examined in relation to geological and topographic diversity. Geological data (Figure 3.2) were obtained from a revised version of Cornec's 1986 geological map. Tiles from the Global Multi-resolution Terrain Elevation Data 2010 30-arc second digital elevation model dataset were downloaded via the United States Geological Survey Earth Explorer website (USGS, 2018). Elevation data (Figure 3.3) were divided into three ranges; 0 - 300 m (low), 300 - 600 m (mid), and 600 - 1100 m (high). Tools in QGIS version 3.2.2 (QGIS Development Team, 2018) were used to generate a terrain ruggedness index (Figure 3.4) from the digital elevation model (the tool calculates terrain ruggedness values using the average of the change in elevation between a pixel and its eight surrounding pixels). Values were classified into four groups as follows (terminology for each class is as per Riley *et al.,* 1999, but the values for each class are specific to Belize): 0 - 57 m (level), 58 - 150 m (slightly rugged), 151 - 291 m (moderately rugged), 292 - 541 m (highly rugged).

Summary statistics for each geological substrate, for each elevational range, and for each class of terrain ruggedness are shown in Table 3.6. Analysis of variance (ANOVA) was used to test for differences in GHI scores, and a Tukeys HSD test was used to identify where significances were. Results are shown in Tables 3.7, 3.8 and 3.9.

3.3 Results

Table 3.1. A Star framework for Belize. Numbers in parenthesis next to Star category indicate the ideal mean number of degree squares occupied. Level of conservation concern is expressed within the context of the global rarity of a species.

STAR	CONSERVATION PRIORITY	DESCRIPTION OF CATEGORY
Black (2.66)	HIGH	‘True’ endemics: range restricted to Belize (e.g. ‘Restricted to the lowland savannas of Belize’) • A species that is endemic to Belize and is common has the same conservation value as a species that is endemic to Belize but is known only from the type locality or is sparsely distributed.
		‘Near’ endemics: range extends into neighbouring regions of Guatemala and / or Mexico (e.g. ‘Restricted to the upper elevations of the Maya Mountains’) • May be common or sparsely distributed within this range. • A species that also has a small number of plausible records from outside of this range would be a candidate for the Black Star category.
Gold (8)	HIGH - MODERATE	Global range is likely to be restricted to eastern states of Mexico and into Central America, but unlikely to extend beyond Honduras. • A species that also has a small number of plausible records from outside of this range would be a candidate for the Gold Star category.
Blue (24)	LOW	Global range is likely to include southern & central Mexico, Central America, the Caribbean, northern Columbia and northern Venezuela. • If records are very sparsely distributed throughout this range, consider upgrading to Gold. • A species that also has a small number of plausible records from outside of this range would be a candidate for the Blue Star category.
Green (72)	LOW - NONE	Global range is likely to include Mexico, southern USA, the Caribbean, Central America and northern South America. • If records are sparsely distributed throughout this range, consider upgrading to Blue. • Cultivated plants should automatically be placed in this category.

Table 3.2. A worked example of calculation of GHI. The result of the GHI calculation is multiplied by 100 and rounded to a whole number to avoid the use of decimal places (Hawthorne & Marshall, 2015).

Star	A = Number of species in sample	B = Weight for Star	A x B
Black	2	27	= 54
Gold	5	9	= 45
Blue	13	3	= 39
Green	50	0	= 0
Total	70		= 140

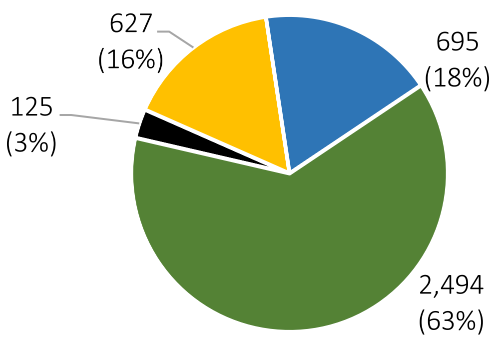
GHI = 100 x (140/70) = **200**

Table 3.3. Ideal mean range (number of degree squares occupied) and corresponding weight for each Star category.

Star	Ideal mean range	Weight
Black	2.66	27
Gold	8	9
Blue	24	3
Green	72	0

Only 3% of the flora of Belize is comprised of taxa that are globally rare (based on range indicated by botanical records). Figure 3.1 shows number of taxa for each of the four Star categories. Of the Black Star taxa, 39 are found only in Belize (see Appendix II for a checklist of accepted names, and corresponding Star rating).

Figure 3.1. Number of taxa (species from the checklist of vascular plants; see Appendix II) per Star (Black, Gold, Blue and Green).



Tree taxa account for the largest proportion of Black (33%), Gold (29%) and Blue Stars (28%). Herbaceous taxa account for the largest proportion of Green Star taxa in Belize (44%).

Table 3.4. Number of taxa per Star for different habit types. Definitions for each habit type are provided in Chapter 2.

	Black	Gold	Blue	Green	Total per habit
Tree	41	190	207	474	912
Herb	34	173	155	1102	1,464
Shrub	20	82	99	296	497
Vine or Liana	11	63	73	225	372
Epiphyte	14	77	89	175	355
Palm	2	14	14	17	47
Fern	3	28	58	205	294
Total per Star	125	627	695	2,494	3,941

A minimum threshold of 50 records per 5 km grid square was selected for analysis of GHI in relation to topographic and geological diversity. Selection was based on summary statistics and analysis of the relationship between GHI and number of records (see Table 3.5). GHI did not increase with increasing number of records per grid cell. The Pearson's product moment test showed no significant correlation for any of the three datasets.

Table 3.5. Summary statistics for the comparison of three potential GHI datasets, and p-values for Pearson's product moment test for correlation between number of records per grid cell and GHI.

Min. records per grid cell	N samples	Standard error	Standard deviation	Skewness	p-values
50	188	5.867	80.877	1.283	0.572
75	135	5.761	66.942	0.011	0.198
100	100	6.530	65.301	-0.133	0.117

Figure 3.2. Preliminary (observed) GHI scores for Belize, mapped in relation to geological substrata. GHI calculated per 5 km grid cell using botanical records from the Belize vascular plant database. Grid cells with fewer than 50 botanical records are not displayed. Geological map is a simplified version of Cornec (1986). Data (shapefiles) were obtained from the BERDS website (Meerman & Clabaugh, 2017).

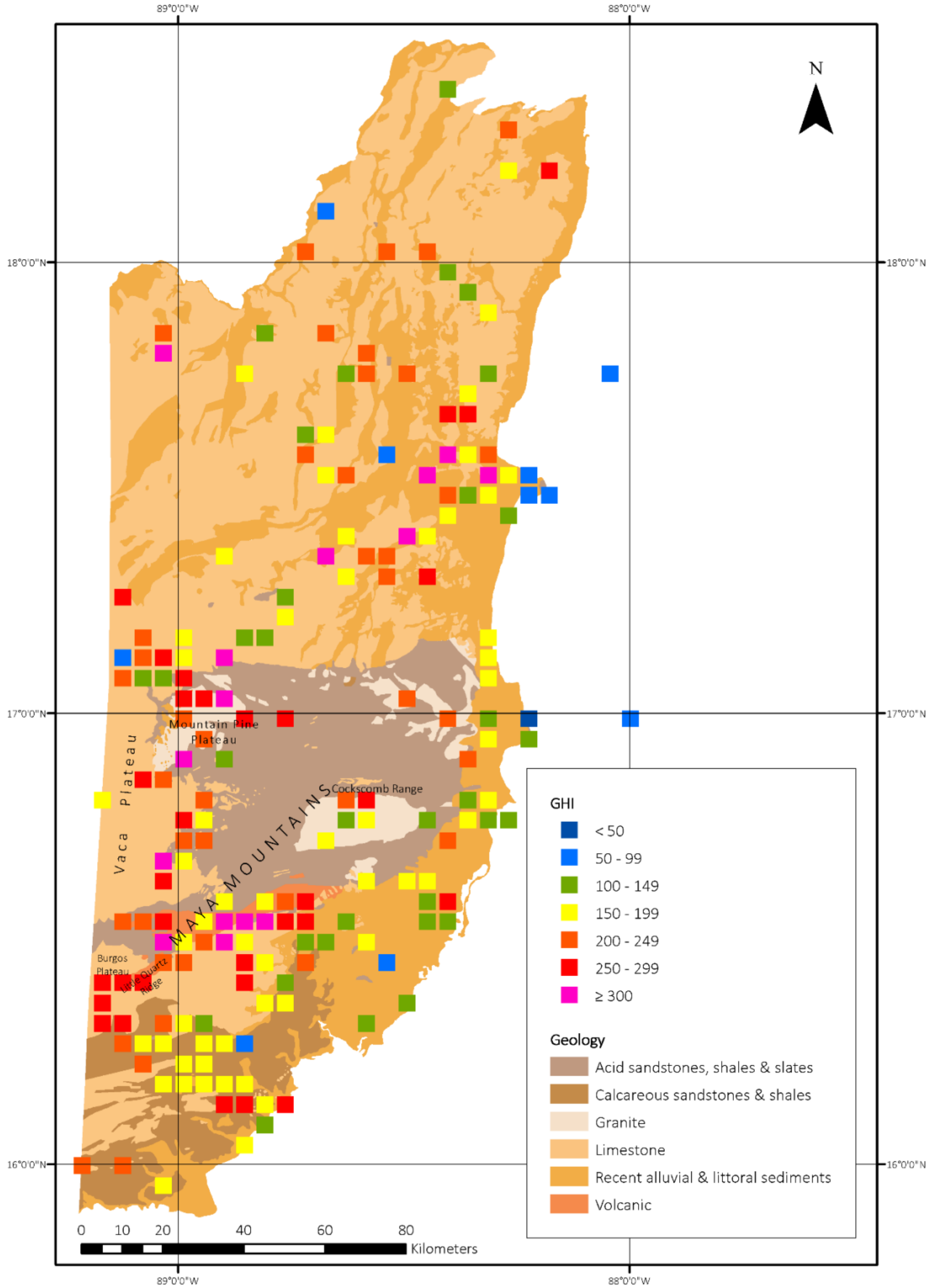


Figure 3.3. Preliminary (observed) GHI scores for Belize, mapped in relation to elevation. GHI calculated per 5 km grid cell using botanical records from the Belize vascular plant database. Grid cells with fewer than 50 botanical records are not displayed. Elevation data obtained from the Global Multi-resolution Terrain Elevation Data 2010 30-arc second digital elevation model dataset.

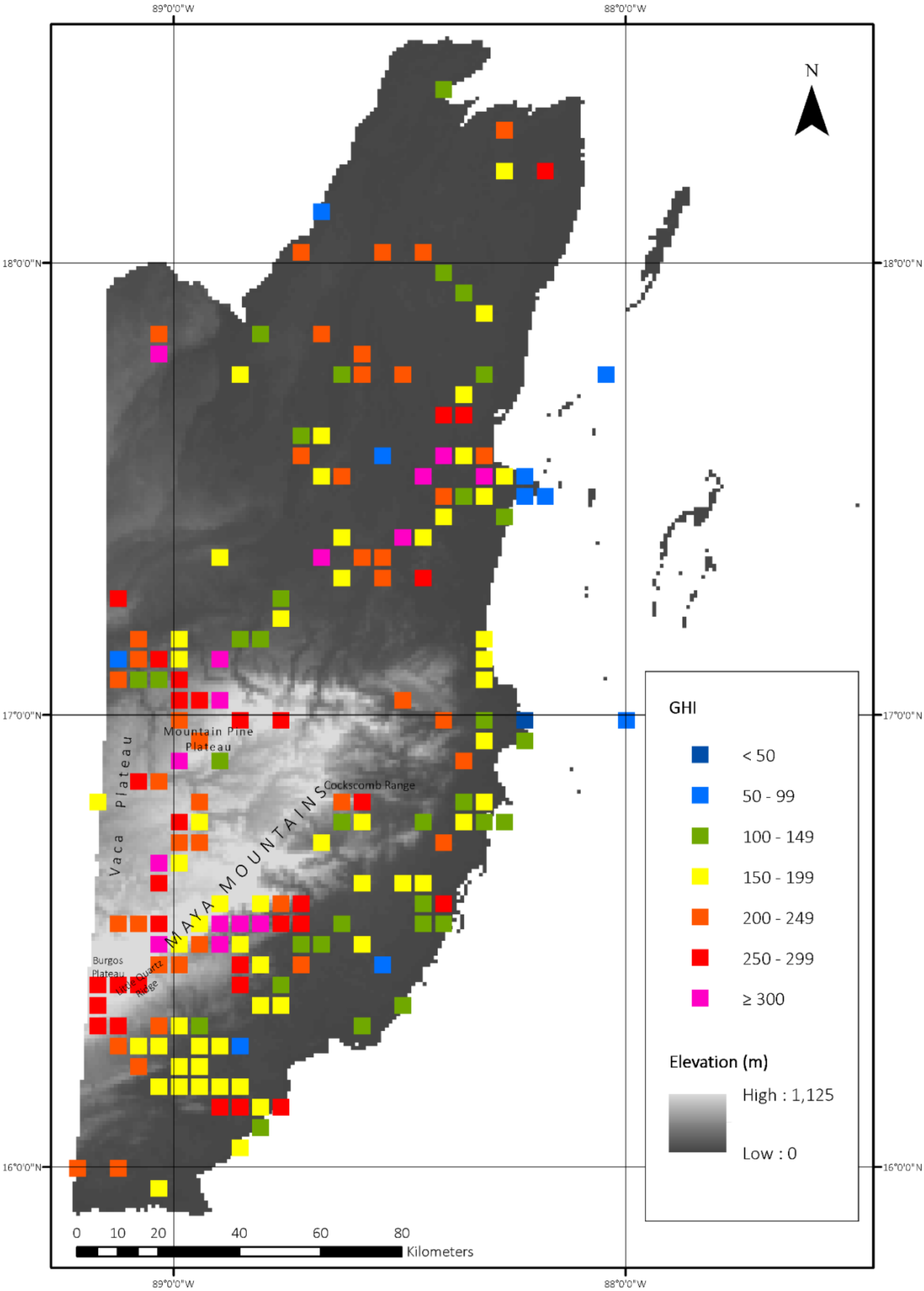
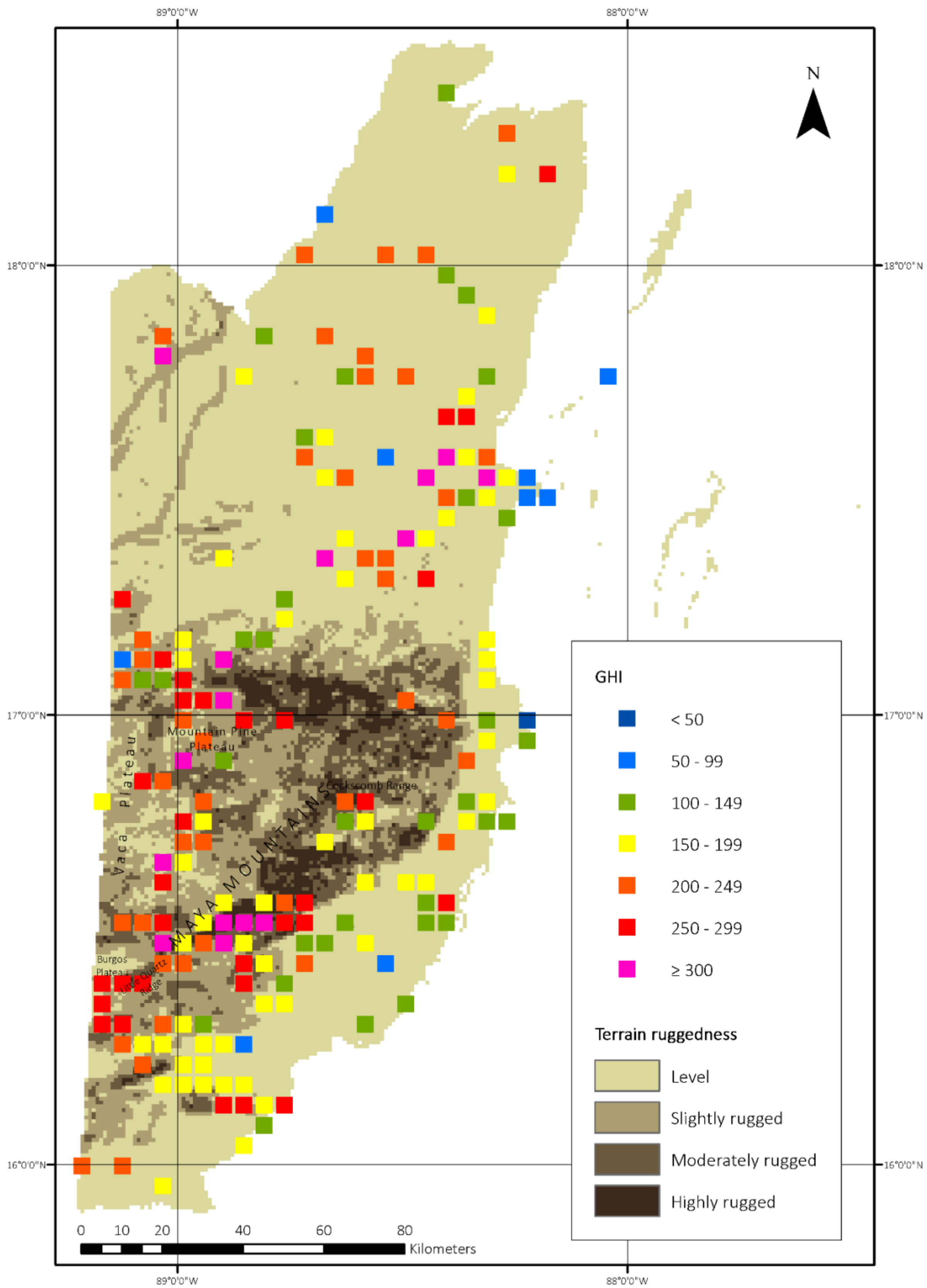


Figure 3.4. Preliminary (observed) GHI scores for Belize, mapped in relation to terrain ruggedness. GHI calculated per 5 km grid cell using botanical records from the Belize vascular plant database. A terrain ruggedness index was derived from the digital elevation model. Terrain ruggedness classes are as follows: 0 - 57 m (level), 58 - 150 m (slightly rugged), 151 - 291 m (moderately rugged), 292 - 541 m (highly rugged).



Of the 188 grid cells (observed GHI scores) shown on the maps in Figure 3.2, 3.3 and 3.4, 28% (52 grid cells) had an observed GHI score >250 (bioquality hotspots). The minimum GHI was 36, the mean GHI was 202, and the maximum GHI was 541.

When examined in relation to geology (Figure 3.2), of these 52 hotspots, 42% were associated with limestone, 19% were associated with the volcanic substrate, 15% were associated with the recent alluvial & littoral sediments, 12% were associated with the acid sandstones, shales & slates, 8% were associated with granite, and 4% were associated with the calcareous sandstones & shales. Due to the differences in surface area associated with each substrate, grid cells with GHI >250 were also examined as a percentage of the total number of grid cells associated with each substrate. 35% of all grid cells associated with the granite substrate were hotspots. 35% of all grid cells associated with the acid sandstones, shales & slates were hotspots. 32% of all grid cells associated with limestone were hotspots. 13% of all grid cells associated with the recent alluvial & littoral sediments were hotspots. 9% of all grid cells associated with the calcareous sandstones & shales were hotspots.

When examined in relation to elevation (Figure 3.3), 44% of grid cells with observed GHI >250 were associated with the low elevation range (0 - 300 m), 25% were associated with the mid elevation range (300 m - 600 m), and 31% were associated with the high elevation range (>600 m). Due to differences in total surface area associated with each elevation range, hotspot grid cells were also examined as a percentage of the total number of grid cells associated with each range. 17% of all grid cells associated with the low elevation range were hotspots. 52% of all grid cells associated with the mid elevation range were hotspots. 67% of all grid cells associated with the high elevation range were hotspots.

When examined in relation to terrain ruggedness (Figure 3.4), 37% of grid cells with observed GHI >250 were associated with level terrain, 33% were associated with slightly rugged terrain, 20% were associated with moderately rugged terrain, and 11% were associated with highly rugged terrain.

Table 3.6. Summary statistics for GHI on each of the six geological substrata, for the three elevational ranges, and for the four terrain ruggedness classes. GHI calculated per 5 km grid cell using records from the Belize database (≥ 50 records per grid cell).

	N samples	Min GHI	Max GHI	Mean GHI	Standard deviation
Geological substrate					
Acid sandstones, shales & slates	17	122	541	249	110.9
Calcareous sandstones & shales	22	84	288	187	47.46
Granite	11	136	325	230	55.1
Limestone	68	65	452	215	72.93
Recent alluvial & littoral sediments	61	36	318	172	67.19
Volcanic	9	176	362	244	56.61
Elevation band					
Low (0 - 300 m)	139	36	405	184	64.53
Mid (300 - 600 m)	25	122	478	250	80.30
High (600 - 1100 m)	24	176	541	265	75.65
Terrain ruggedness class*					
Level	119	36	452	185	67.47
Slightly rugged	35	65	325	218	61.36
Moderately rugged	22	120	541	247	91.55
Highly rugged	12	176	478	259	91.31

*Terrain ruggedness classes are defined as shown in Figure. 3.4.

Due to differences in total surface area associated with each terrain ruggedness class, hotspot grid cells were also examined as a percentage of the total number of grid cells associated with each class. 14% of all grid cells associated with the level terrain class were hotspots, 43% of all grid cells associated with the slightly rugged terrain class were hotspots, 41% of all grid cells associated with the moderately rugged terrain class were hotspots, and 42% of all grid cells associated with the highly rugged terrain class were hotspots.

Acid sandstones, shales & slates had the highest mean GHI (249) of the six geological substrata (Table 3.6). The high elevation band (> 600m) had the highest mean GHI (265). The highly rugged terrain had the highest mean GHI.

Analysis of variance revealed an overall significant difference between GHI scores on geological substrata (Table 3.7), in the three elevational ranges (Table 3.8), and in the four classes of terrain ruggedness (Table 3.9).

Table 3.7. ANOVA for GHI scores (calculated per 5 km grid square) for six geological substrata.

Source of variation	Sum of squares	Degrees of freedom	Mean square	F	*p*
Between groups:	133210	5	26642.1	5.227	0.000165
Within groups:	927650	182	5096.98		
Total:	1060860	187			

Tukey's Honest Significant Difference (HSD) test revealed significant differences between the recent alluvial & littoral sediments and the acid sandstones, shales & slates ($p<0.001$), and also between recent alluvial & littoral sediments and limestone ($p<0.01$).

Table 3.8. ANOVA for GHI scores (calculated per 5 km grid square) for three elevational ranges.

Source of variation:	Sum of squares	Degrees of freedom	Mean square	F	*p*
Between groups:	199736	2	99868.1	21.46	0.000000004
Within groups:	861124	185	4654.72		
Total:	1060860	187			

Tukey's HSD test revealed significant a difference between GHI scores on the low and high elevations ($p<0.0000006$), and between GHI scores on the low and mid elevations ($p<0.00004$).

Table 3.9. ANOVA for GHI scores (calculated per 5 km grid square) for four classes of terrain ruggedness.

Source of variation	Sum of squares	Degrees of freedom	Mean square	F	*p*
Between groups:	127853	3	42617.6	8.405	0.000029
Within groups:	933007	184	5070.69		
Total:	1060860	187			

Tukey's HSD revealed a significant difference between GHI scores on level and highly rugged terrain ($p<0.0038925$), and between GHI scores on level and moderately level terrain ($p<0.0012412$).

3.4 Discussion

Results presented in this chapter suggest that there are bioquality hotspots within the flora of Belize, and that the distribution of these hotspots is affected by geological and topographic diversity. However, these results should be interpreted with caution because there were not an equal number of samples (5 km grid cells that had sufficient records for GHI calculations) for each geological substrate, elevation range, or terrain ruggedness class (i.e. spatial bias in the Belize dataset, as examined in Chapter 2, is likely to be affecting the results). However, the results are still useful for guiding the direction of future in situ sampling.

Over half the flora of Belize is comprised of taxa that have a widespread Neotropical distribution. Only 3% of the flora is made up of taxa that are globally rare (Black Stars). These results support the findings of previous studies (Balick *et al.,* 2000; Brewer *et al.,* 2003) which suggest endemism in the vascular plant flora of Belize is low. The flora of Trinidad and Tobago was recently examined using the RBS framework (Baksh-Comeau *et al.,* 2016), and was also found to have low endemism (Black Stars accounted for 3% of the total flora). This was attributed to the islands' close proximity to (and recent separation from) the south American continent. Low endemism in the flora of Belize is also attributed to its geographic position. The flora of Central America has strong affinities with the South American flora, and to a lesser extent, the north American flora (Gentry, 1982). One study reported that 60% of the tree species documented in two one-hectare permanent sample plots on a valley floor (c. 45 m elevation) in the Bladen Nature Reserve have ranges that stretch from Mexico or Guatemala to South America (Brewer & Webb, 2002).

For the north of the country, limited sampling makes it very difficult to determine patterns in GHI. Northern Belize forms part of the biogeographically distinct Yucatán Peninsula which has often been reported as having high levels of endemism (Ibarra-Manriquez *et al.*, 2002 and references therein). The species composition of the hotspot in the far north of Belize appears to reflect this. The high GHI score is generated not by Black Star species (1) but by Gold (13) and Blue (35). The distribution of records for these species suggests they are largely concentrated in the Yucatán Peninsula.

The majority of GHI scores greater than 200 that can be seen in the northern half of Belize are associated with lowland savanna (on recent alluvial & littoral sediments, according to the geological map). Goodwin *et al.* (2013) highlighted lowland savanna as an area of conservation value, reporting that 18 of Belize's endemic plant species are found there; six of these are found only in lowland savanna. They suggested that lowland savanna was under-represented with the National Protected Areas System, with only 26% within protected areas. They also highlight the threat of land-use change, citing a technical report (Cameron *et al.,* 2010) which calculated that approximately 200 km^2 (12%) of lowland savanna had been converted to other land uses since 1980. It is not known if there has been further loss of savanna in the eight years since this report was published. Despite being repeatedly highlighted as being of floristic importance for Belize and the Mesoamerican region, there has been no recent national-level action in terms of increasing the amount of lowland savanna under protection.

In the central portion of the country, as with the north, it is difficult to determine local patterns due to sparse sampling. There are a cluster of hotspots on the granite substrate which continue towards the west as the underlying geology transitions into acid sandstones, then into limestone. These hotspots are found within all three elevation ranges but appear to be located mostly on terrain that is level. Several fall within the Mountain Pine Ridge[10] Forest Reserve and occur within vegetation that was classified as 'submontane pine forest' (Meerman & Sabido, 2001). It has also previously been described as 'pine savanna' (savanna with scattered pines), or 'pine ridge' (savanna with a dense occurrence of pine). Hotspots in this location are due to the presence of many of the lowland savanna endemics (Goodwin *et al.,* 2013).

The Maya Mountains and adjacent areas are shown to be of high conservation value. Transitions in underlying geology (which would result in heterogeneity of soils, and nutrient and moisture availability) appear to be associated with high GHI. This is most noticeable in the south of the country, where the volcanic and limestone substrata meet. Most of the hotspots in this area fall within the mid elevation range (300 - 600 m), in areas where the terrain is classified as moderately or highly rugged. This area is largely under protection and many of the hotspots are within Bladen Nature Reserve (see National Protected Area System map in

[10] In Belize, the term 'ridge' is often used in describing vegetation types. It usually refers to a strip of vegetation rather than a topographic feature. 'Broken ridge' refers to forest with an uneven canopy.

Chapter 1). Relative to other protected areas in Belize, there is a high level of patrolling in the Bladen Nature Reserve (particularly the eastern side), and it is one of the few protected areas in country that has an active biodiversity research and monitoring programme (see Chapter 1). The combination of remote location and rugged terrain, together with the regular presence of rangers within the reserve, and the fact that access is for scientific or education purposes only, is likely to mean that these hotspots are some of the best protected in Belize.

In contrast, and perhaps of the most conservation concern, is the cluster of hotspots around the Burgos Plateau/Little Quartz Ridge area (where the western end of the volcanic substrate meets the limestone substrate). These hotspots all fall within the high elevation range (>600 m). Terrain in this area varies from highly rugged to almost level, as the western flank of Little Quartz Ridge descends into the Burgos Plateau. Although within a protected area (Columbia River Forest Reserve), there is currently no on-the-ground management in place (pers. comm., Ya'axché, 2011). A brief report following a flight over the area (Brewer, 2014b) suggested that the Burgos Plateau has a high diversity of forest types, with the hypothesis that this is due to heterogeneity in underlying geological substrata. Disturbance to the vegetation appeared patchy but the northern third of the plateau seemed relatively intact, the hypothesis being that Little Quartz Ridge offers some protection from hurricanes. The most recent collections in the area were in 2009, and the majority were collected over 30 years ago. The western portion of the Columbia River Forest Reserve would be a priority for in situ surveys to determine the reliability of the preliminary GHI scores.

The flora of the recent alluvial & littoral sediments had the lowest mean GHI and would therefore be of low conservation concern (except for the patches of lowland savanna). This substrate falls entirely within the low elevation band, and the level or slightly rugged terrain class. As hypothesised in Chapter 2, high species richness on this substrate is likely to be associated with high levels of natural and anthropogenic disturbance, i.e. a high turnover of successional taxa. Low GHI (relative to other substrata) provides evidence that the flora on this substrate is largely composed of taxa that have a wide Neotropical distribution (Green Stars). The exception is a hotspot near the coast in the south east. The species composition of this hotspot includes five Black Star taxa. Associated records were collected by Schipp in 1933 or by Gentle in 1944 but there are no collections with more recent dates. Determinations in the

Belize database match those at Tropicos, and locality data text matches coordinates. This hotspot seems to be something of an anomaly and is worthy of further in situ investigation since there are no other hotspots occurring along the coast.

GHI scores generated from a dataset largely comprised of herbarium voucher specimens can be useful for identifying patterns in bioquality, and for developing hypotheses that can be tested in the field. However, it would be unwise to make management decisions based on these data alone because they are biased (as discussed in Chapter 2). The botanical records used for calculations are unlikely to represent the flora of the site fully, unless systematic sampling of the whole flora has taken place. The results presented here will be useful to prioritise areas for in situ surveys. First, to areas that appear on the map as hotspots, to determine whether the GHI scores are reliable. Second, to areas that are under-sampled but have similar geological and topographic conditions to areas where there are hotspots. An intermediate step (rather than proceeding directly to in situ surveys) is to predict hotspots using species distribution models. Chapters 4 and 5 explore the use of two community-level modelling methods to predict bioquality across Belize.

CHAPTER 4

Species richness and bioquality predictions using stacked species distribution models

4.1 Introduction

Species distribution modelling (SDM)[11] is based on the premise that the observed distribution of a species provides insight into its environmental requirements (Pearson *et al.,* 2007). Two types of input data are required for SDM: occurrence data (which can be presence-only, presence-absence, or abundance, depending on the modelling method used) for the species of interest and environmental predictor variables. Models are based on the relationship between the occurrence data (the response variable) and the environmental predictor variables, and patterns are extrapolated across the area of interest. SDM has been used to address a wide range of research questions and is increasingly applied to conservation planning and land management, for example, to model the potential spread of an invasive species, or to predict species' range shifts in response to climate change. A common use of SDM, often applied to rare species, is to predict their occurrence across areas where survey data are lacking, with the aim of discovering previously unknown populations (e.g. Gogol-Prokurat 2011; Fois *et al.,* 2015).

A relatively recent development in the field is the use of stacked SDM (hereafter referred to as 'SSDM') as a means to predict attributes of biodiversity at the community level (e.g. species richness) using species level data (e.g. Gioia *et al.,* 2000; Schmidt *et al.,* 2005; Mateo *et al.,* 2012). The results of SDM of individual species are combined to derive the required community-level attribute (Ferrier & Guisan, 2006). The final output is usually a thematic map. SSDM (also referred to as the 'predict first, assemble later' strategy) is based on the theory that

[11] Also referred to as ecological niche modelling, or habitat suitability modelling. For this research, the term 'species distribution modelling' is preferred because it more accurately describes both the process and the results (Franklin, 2010).

a plant community arises as a result of the coincidental assemblage of the ecological responses of individual species to their environment (Gleason, 1939), as opposed to the view that a plant community is a distinct entity (Clements, 1916). Previous studies have used SSDM to predict species richness, and to identify plant diversity hotspots (e.g. Murray-Smith *et al.,* 2008; Parviainen *et al.,* 2009).

Objectives

To test the use of SSDM to predict species richness across Belize, and to generate a bioquality map.

4.2 Materials and methods

Modelling method

The most commonly used modelling methods in published studies that relate to conservation are either statistical methods (e.g. Generalised Linear Models or Generalised Additive Models) or machine-learning methods (e.g. Maximum entropy or decision trees). Information from several comparative studies (including Elith *et al.,* 2006; Benito *et al.,* 2013; Lentini & Wintle 2015) and Franklin's (2010) comprehensive section on model types were used to inform model selection for this research.

Maxent (Phillips, Dudík, & Schapire, 2018) is a machine-learning method that estimates the target distribution of a species by finding the distribution of maximum entropy: that which is closest to uniform across environmental space. It was originally designed to estimate the density of presences and its raw output is a relative occurrence rate (ROR). Predicting a probability of presence is made possible using a transformation of the ROR, referred to as 'logistic output'. The logistic output relies on input data (occurrence records) meeting assumptions about detectability (that probability of detection is uniform across the area of interest), and sampling (that it is either random, or representative throughout the area of interest). If these assumptions are not met, environmental bias is likely because of the over-representation of certain environmental conditions of the more accessible and/or extensively surveyed areas. Although Maxent was specifically developed for use with museum and herbarium data, such datasets often do not meet these assumptions. This is an area where Maxent has been criticised (e.g. Royle *et al.,* 2012; Yackulic *et al.,* 2013), although Phillips *et al.,* (2009) suggest that inference from presence-only modelling is fairly robust to sample bias if background points (locations where presence/absence is not known - see below) have the same sample selection bias as the presence points.

Despite criticism, Maxent is widely used and has repeatedly outperformed other types of model based on predictive accuracy (Merow *et al.,* 2013). For this research, the most important criterion for model selection was a proven ability to achieve good predictive performance at low sample sizes (because many Black Star taxa on the checklist, and some Gold Star taxa, had few occurrence records). In addition, Maxent can handle presence-only data, and categorical predictor variables can be used without introducing complexity to the output (which can then become difficult to interpret).

Occurrence data

Occurrence records for all taxa from the working checklist of vascular plants (see Chapter 2, Appendix II) were downloaded from GBIF. Filters were applied to the download so that names of taxa and authors matched those on the checklist. Only records with coordinates, and those with 'no known coordinate issues' (according to GBIF) were included. Since it was not feasible to check species determinations on individual records, it was assumed that the scientific name assigned to a particular record was the correct determination. The pace of taxonomic research, and the management of collections, means that this is not always the case. In an effort to reduce the likelihood of including records with doubtful determinations, only records from the Missouri Botanic Garden dataset were included in the download. Their ongoing work on *Flora Mesoamericana* (Davidse *et al.,* 1994-) is likely to mean that a large proportion of their Mesoamerican specimens have been re-examined relatively recently, therefore improving the reliability of species determinations. Records from Belize were removed from the GBIF dataset. Due to efforts described in Chapter 2, the Belize database is likely to represent data that is of higher quality than a raw GBIF download, particularly in terms of locality data.

Occurrence records from the GBIF dataset were mapped in ArcMap to check for obvious geographic errors (e.g. a point appearing in the wrong country, or in the sea) and outliers. These records were corrected where possible or removed.

Environmental data

A preliminary dataset of 26 environmental predictor variables were assembled, selected based on previously published research, and on results from data analysis in Chapters 2 and 3. The dataset included 19 bioclimatic variables from the Bioclim dataset (available to download at www.worldclim.org/bioclim), six topographic variables (derived from the Global Multi-resolution Terrain Elevation Data 2010 digital elevation model, available to download via https://earthexplorer.usgs.gov/), and lithology (from the Global Ecological Land Units dataset, available to download at https://rmgsc.cr.usgs.gov/outgoing/ecosystems/Global/). High resolution data (30 arc-seconds, c. 1 km) were selected as they produce better predictions for plants then data at coarser resolutions (Guisan & Thuiller, 2005). Data were formatted to the same geographic extent, and geographic coordinate system (World Geodetic System 1984 datum) using ArcMap 10.4.1 and/or QGIS Desktop 2.8.2. The process for selecting the final set of environmental variables is detailed below.

Background points

Occurrence data for SDM would ideally be obtained via systematic sampling, resulting in a presence/absence dataset. If absence data are not available 'background data' are used. A 'background point' represents a location (within the geographic extent of the environmental data layers) where presence/absence is not known. Background data are not 'guesses' of absence locations but instead attempt to characterise environments across the area of interest (Hijmans & Elith, 2013). Every pixel within the spatial extent of the environmental data has the same probability of being selected by Maxent as a background point. If a species is modelled using a spatial (geographic) extent that extends beyond the known area of occurrence, it is possible that Maxent will select background points where values of the environmental data are outside of the range tolerated by the species. To improve the accuracy of models, the spatial extent of the environmental data layers can be modified, therefore limiting the area from which background points are selected, and subsequently decreasing the range of variability of the environmental predictor variables (Merow *et al.*, 2013). An ecological-based approach would be to limit spatial extent based on known dispersal limits, but this becomes impractical when modelling large numbers of species. The spatial extent of the environmental predictor variables can be modified for multiple species simultaneously using 'mask files'. A mask file is a raster layer that is formatted to the required spatial extent (see below for details), and that is placed above the environmental data layers in the Maxent interface, thereby restricting the area from which Maxent can select background points.

Mask files were developed according to the Star (details in Chapter 3) that each species was assigned to. For each Black Star taxon, an individual mask file was created. Occurrence records were mapped in ArcMap and a minimum convex polygon (MCP) was drawn around points. A 5 km buffer was added as standard to the outside of the MCP so that no presence points were precisely at the perimeter. When considering the size of buffer area to draw around known occurrences, in order to capture other likely points between known ones, it could be proposed that the buffer width should reflect the dispersal ability of the species. However, it was decided that hypothesizing as to dispersal limitations would add uncertainty to the model, and that the buffers should be based, as much as possible, on known distribution data. Gold, Blue and Green Star taxa were modelled using a mask file that represented the core area of occupancy for each Star. This was defined by mapping all botanical records associated with each Star, in turn, then performing a density analysis in ArcMap. A minimum convex polygon was drawn around the perimeter of the areas with high - medium density of records.

Maxent settings

Maxent models can be run with a variety of user-defined settings, or with default settings. Default settings were developed based on performance across a range of taxonomic groups (Phillips & Dudík, 2008) and are therefore useful when building models for many species simultaneously, when species-specific tuning is impractical (Merow *et al.,* 2013). To assist in selecting and standardizing settings for this research, a trial set of 80 species (20 from each Star) were modelled. Maxent settings took into consideration guidelines in Franklin (2010) and Merow *et al.,* (2013). The aim was to determine which settings attained the best predictive performance. The trial dataset included taxa that had low numbers of records, and taxa with varying prevalence (even or patchy distribution within known range) of records. Within-model testing (to evaluate predictive performance) was carried out using five replicate runs with cross validation. Cross validation randomly splits occurrence data into *n* equal-size groups. Models are run omitting each group in turn. The group that is omitted is used for evaluation, thereby making better use of small datasets. Replication allows Maxent to run a series of analyses that assist the user in evaluating the predictive performance of each model. To evaluate predictive performance, the analysis of omission/commission graph, the receiver operating characteristic (ROC) curves and associated AUC (area under the curve) value were examined (examples are provided in Appendix IV). The AUC value indicates whether a randomly chosen presence has a higher probability of occurrence than a randomly chosen background point. The following guidelines for interpreting the AUC statistic were used: excellent (0.90 - 1.00), very good (0.8 - 0.9), good (0.7 - 0.8), fair (0.6 - 0.7), and poor (0.5 - 0.6) (Ren-Yan *et al.,* 2014 and references therein).

Maxent also generates analyses that provide insight into the importance of each environmental variable in terms of its individual contribution to the 'fit' (or 'gain') of the model. Previous studies indicate that limiting the number of variables in a model reduces model complexity and therefore reduces overfitting (Fois *et al.,* 2015). To assess which variables mattered most to the distribution of each species in the trial dataset, the analysis of variable contributions, Jackknife training and test gain graphs, and Jackknife AUC graphs were examined. The ecological plausibility of each model was examined using species response curves (see examples in Appendix IV). Table 4.1 lists the nine predictor variables selected for use with all taxa in the final Maxent models.

Table 4.1. Nine environmental predictor variables selected for inclusion in the final models.

Variable	Source dataset
Lithology (geology & soils)	Global Ecological Land Units dataset, available to download at https://rmgsc.cr.usgs.gov/outgoing/ecosystems/Global/
Terrain Ruggedness Index, Topographic Position Index, Landform, Aspect	Derived from the Global Multi-resolution Terrain Elevation Data 2010 digital elevation model, available to download via https://earthexplorer.usgs.gov/
Bio5 (max temperature warmest month) Bio6 (min. temperature coldest month) Bio13 (precipitation wettest month) Bio14 (precipitation of driest month)	WorldClim dataset (available to download at www.worldclim.org/bioclim

There is continuing debate as to the minimum number of records that can be relied upon to produce a model with good predictive performance. There appears to be a consensus that predictive performance is poor with low numbers of records. Based on previous literature (e.g. Pearson *et al.,* 2007; Wisz *et al.,* 2008; van Proosdij *et al.,* 2016), taxa with fewer than five records were not modelled (but known points were still included in the stacking process described below).

Maxent's default settings consistently produced the best predictive performance in the trial dataset. Due to the large number of species being modelled, and the subsequent impracticality of species-specific tuning, default settings (with five replicate runs, using the cross-validation method described above) were used for all taxa. In cases where default settings produced an AUC value of <0.5 (below the value considered 'poor' - see above), taxa were remodeled with user-defined settings. Table 4.2 shows the final number of taxa modelled and mapped for each of the four Star categories.

Reclassification and stacking Maxent output files

Maxent generates a file (ASC format) that shows a continuous probability distribution (probability of presence, values of 0 – 1) for the species across the area of interest (see example in Appendix IV). The file showing the average of the five replicate runs was selected and reclassified to represent binary (presence/absence) data using the 'ten percentile training presence' threshold value generated by Maxent (see examples in Appendix IV). The 'minimum training presence' threshold value is the lowest probability value for any pixel that contains an actual presence record. In ecological terms the value can be interpreted as representing the probability of presence where the environmental conditions are least suitable for the species (Pearson *et al.,* 2007). The ten-percentile training presence threshold value takes this a step further by excluding the lowest 10% of the probability values associated with presence records. In addition to providing a more conservative estimate of the distribution of a species (which in turn should result in a conservative estimate of species richness), the ten-percentile training threshold also serves as an additional means to address error in the dataset because it excludes presence records that are outliers (in terms of the environmental conditions at site of collection).

Taxa that could not be modelled due to insufficient records were mapped, data were converted to a raster file (resolution of 1 km grid cell, i.e. the same resolution at which taxa were modelled) and added to the stack (see below). Presence/absence maps were stacked in ArcMap to derive predictions of species richness. Species richness was used to calculate GHI (sample calculation is shown in Chapter 3). The resulting species richness and bioquality maps are shown in Figures 4.1 and 4.2.

Testing predictions

Data from the Belize vascular plant database were used to check whether the final species richness map (Figure 4.1) was likely to be over or under-inflating species richness. The diversity analysis tool in BRAHMS was used to classify georeferenced botanical records from the Belize dataset into 1 km grid cells (the same resolution as species richness predictions). Figures for observed species richness were generated for each grid cell (using species and infra specific taxa). The top fifty best-sampled (in terms of numbers of botanical records) grid cells were used to generate estimates of species richness using the iNEXT package (sample-size based rarefaction and extrapolation) in R (R Core Team, 2017). Minimum, maximum and mean values from the estimates were compared to values from predictions. Results are shown in Table 4.3.

The accuracy of GHI predictions from the final bioquality map (Figure 4.2) was tested using an independent data set. This was comprised of 55 samples from Quintana Roo (Mexico) and 30 samples from the Toledo District of Belize. For both datasets, sampling methodology followed Hawthorne & Marshall (2015). Quintana Roo data were collected as part of a DIFD (Department for International Development) project (Hawthorne & Hughes, 1997). The Belize data were collected in 2016 as part of this research. GHI from the independent dataset was mapped and overlaid onto the GHI predictions to determine if the predicted scores matched, or the degree to which they varied from observed GHI. Observed GHI scores from the test dataset were placed into one of seven GHI value groups (see map legend, Figure 4.2). Predictions were considered accurate if they were within the same group as the observed GHI value.

Patterns in species richness and GHI

Patterns in species richness predictions (Figure 4.1) and bioquality (Figure 4.2) were examined in relation to underlying geology, elevation and terrain ruggedness. The SSDM map of GHI predictions (Figure 4.2) was compared to the preliminary (observed data) bioquality map presented in Chapter 3 (Figure 3.2) to determine if there were affinities between the two.

4.3 Results

Summary statistics and predictive performance of models

95% of taxa from the checklist of accepted names (compilation of checklist is discussed in Chapter 2 and presented in Appendix II) were modelled, and 2% were mapped (insufficient records for modelling). Cultivated taxa (102) were excluded from SSDM.

Table 4.2. Number of taxa modelled or mapped for each Star category.

	Modelled	Mapped	Total
Black	59	66	125
Gold	607	20	627
Blue	695	0	695
Green	2,494	0	2,494

Table 4.3. Minimum, mean, and maximum AUC values (generated by Maxent, from within-model testing using five replicate models runs with cross-validation) for all taxa modelled, in each of the four Star categories.

	Min	Mean	Max
Black	0.511	0.710	0.932
Gold	0.501	0.859	0.999
Blue	0.503	0.928	1
Green	0.5	0.896	1

In terms of the predictive performance of the Maxent models, the mean AUC values (Table 4.3) for all four Star categories fall within the excellent, very good, good or fair ranges as defined by Ren-Yan *et al.,* 2014 (see above).

Table 4.4. Minimum, maximum and mean values for observed species richness (SR) per 1 km grid cell, derived from botanical records in the database. Values for estimated species richness (including lower and upper confidence levels) per 1 km grid cell were generated using the Chao1 equation within the iNEXT package in R. Values for predicted species richness per 1 km grid cell were derived from stacked species distribution models.

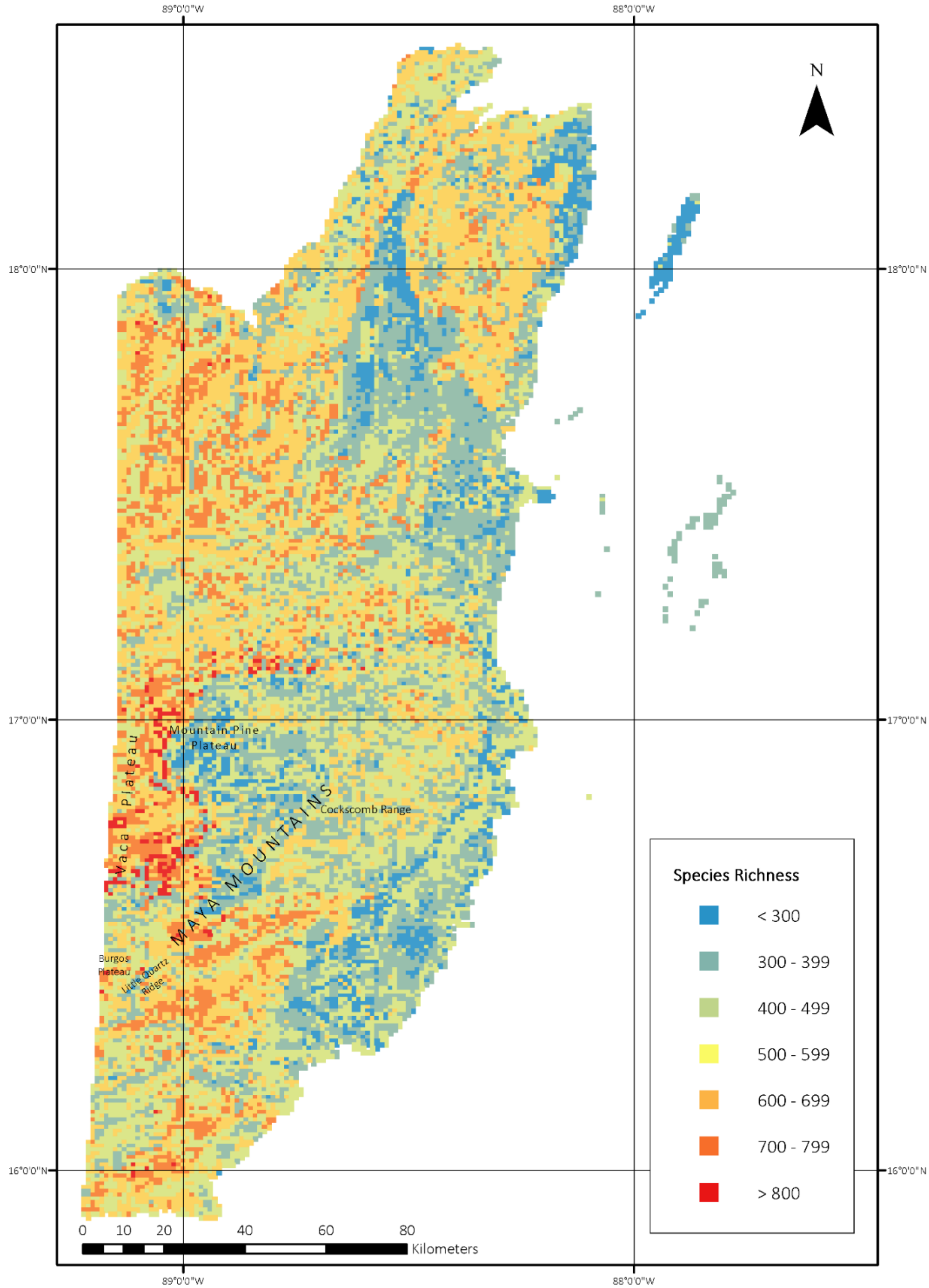
	Observed SR	Predicted SR	Estimated SR	LCL for estimated SR	UCL for estimate SR
Min	86	274	119	104	136
Max	334	917	1256	613	2747
Mean	151	560	444	311	697

In Table 4.4, mean predicted species richness (derived from stacked individual species distribution models) per 1 km grid cell was more than 3 times higher than the mean observed species richness (calculated from records in the Belize dataset), and also higher (by 116 species) than the mean estimated species richness generated by the Chao1 equation. This suggests the stack of individual models tended to over inflate species richness.

Patterns in species richness

In Figure 4.1, the majority (58%) of grid cells were predicted to have a species richness value of between 500 - 700. 32% of grid cells had a species richness value of <500, and 10% of grid cells had a species richness value of >700.

Figure 4.1. Predictions of species richness for Belize per 1 km grid cell, derived from stacked species distribution models. Individual species modelled using Maxent. Colours on the map relate to number of species per grid cell.



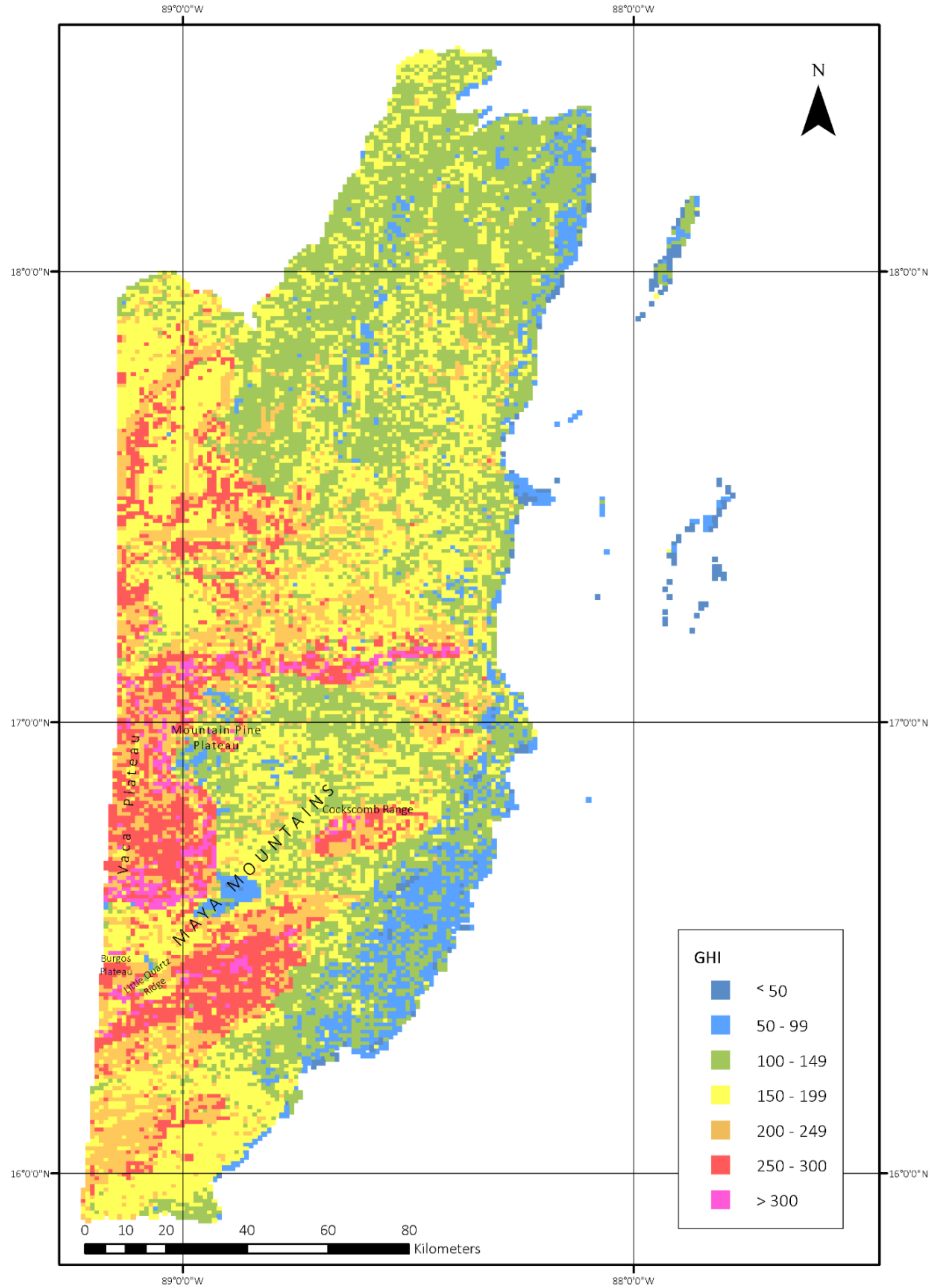
When examined in relation to underlying geology (Chapter 1, Figure 1.2), 42% of grid cells associated with the recent alluvial and littoral sediments had predicted species richness values of <500. These values are visible in a distinct band (blue – green cells) along much of the east coast, where the terrain is level. Predicted species richness values rose further inland on the same substrate, with 53% of grid cells having a predicted species richness value between 500 - 700. Only 5% of cells associated with the substrate were predicted to have species richness values >700.

The low - moderate species richness (predicted species richness values of up to 700) in the centre of the country was associated with the block of acid sandstones (including the granite intrusions). Species richness declined on this substrate with increasing elevation (towards the west of the country). Less than 0.2% of cells associated with this substrate were predicted to have low species richness values (≤500), and 0.4% of cells were predicted to have high species richness values (>700).

43% of grid cells associated with limestone were predicted to have species richness values of <500. Species richness values on limestone increased towards the west of the country (i.e. the dark orange and red cells on the map). 45% of grid cells associated with this substrate were predicted to have species richness values between 501 – 700, and 11% were predicted to have high species richness values (>700). These high values are visible towards the west of the country (around the Vaca Plateau), where the high elevation terrain is rugged (see Chapter 2, Figure 3.4) due to the karstification of the limestone. All grid cells associated with the volcanic substrate were predicted to have species richness values between 501 - 700. There were no obvious visual patterns relating to increasing or decreasing species richness values in relation to the volcanic substrate.

On the calcareous sandstones & shales, 51% of grid cells were predicted to have species richness values between 501 - 700, and 49% of grid cells were predicted to have species richness values of >700. There were no obvious visual patterns relating to increasing or decreasing species richness values in relation to the calcareous sandstones.

Figure 4.2. Predictions of bioquality for Belize. GHI was calculated per 1 km grid cell from SSDM predictions of species composition.



Accuracy of predictions

A total of 38 (45%) observed GHI scores were correctly predicted within the same GHI value group. Of the 47 incorrect predictions, 44 were one, two, three or four groups higher than observed GHI scores and three were one group lower, showing a tendency to over inflate GHI. Prediction accuracy was slightly better for the Belize test data (45% correct) than for Quintana Roo test data (43% correct).

Patterns in GHI

The maximum predicted GHI score on the map in Figure 4.2 was 404, the mean was 172, and the minimum GHI was 0 (i.e. only Green Stars predicted in that grid cell). 12% (3,229) of the grid cells on the map in Figure 4.2 were predicted to have GHI >250 (hotspots). When examined in relation to geology, elevation and terrain ruggedness (see maps in Chapter 3, Figure 3.2, 3.3 and 3.4), Table 4.5 shows that the majority of hotspots on the map in Figure 4.2 were associated with limestone, with the low elevation range, and with slightly rugged terrain.

Table 4.5. Number (and percentage) of grid cells in Figure 4.2 that were predicted to have GHI >250 for each of the six geological substrata, for each of the three elevation ranges, and for each of the four terrain ruggedness classes.

	Number of grid cells with GHI >250	% of grid cells
Geological substrate		
Acid sandstones, shales & slates	276	9
Granite	224	7
Limestone	2170	67
Recent alluvial & littoral sediments	290	9
Calcareous sandstones & shales	194	6
Volcanic	75	2
Elevation range		
Low (0 - 300 m)	1846	57
Mid (300 - 600 m)	999	31
High (> 600 m)	384	12
Terrain Ruggedness Class		
Level	1219	38

Slightly rugged	1347	42
Moderately rugged	553	17
Highly rugged	110	3

Due to the differences in surface area occupied by each geological substrate (or elevation range, or terrain ruggedness class), hotspot grid cells were examined as a percentage of the total number of grid cells associated with each substrate (and elevation range, and terrain ruggedness class). Table 4.6 shows that the volcanic substrate, the mid elevation range, and the slightly rugged terrain class had the highest number of hotspots relative to total surface area.

Table 4.6. Number (and percentage) of grid cells with predicted GHI >200, relative to the total number of grid cells associated with each of the six geological substrata, each of the three elevational ranges, and each of the four terrain ruggedness classes.

	Total number of grid cells	Number of grid cells with GHI >250	% of grid cells with GHI >250
Geological substrate			
Acid sandstones, shales & slates	3700	276	7
Granite	966	224	23
Limestone	12092	2170	18
Recent alluvial & littoral sediments	7399	290	4
Calcareous sandstones & shales	1774	194	11
Volcanic	314	75	24
Elevation range			
Low (0 - 300 m)	20934	1846	9
Mid (300 - 600 m)	3080	999	32
High (> 600 m)	2231	384	17
Terrain Ruggedness Class			
Level	17688	1219	7
Slightly rugged	4729	1347	28
Moderately rugged	2780	553	20
Highly rugged	1048	110	10

Affinities with the preliminary bioquality map

When visually examined, GHI distribution patterns in the SSDM map (Figure 4.2) showed some affinities (i.e. grid cells at the same location had the same GHI) with distribution patterns on the preliminary bioquality map (observed GHI, calculated from records in the Belize dataset) presented in Chapter 3 (Figure 3.2). The SSDM map reflected the diagonal band of high GHI seen in the preliminary map, running along the eastern flank of the Maya Mountains (limestone, and where the limestone meets the volcanic substrate) and up into the Burgos Plateau (limestone), and around Little Quartz Ridge (volcanic). Patterns in high GHI were also similar towards the western border with Guatemala, on the Vaca Plateau (mid-elevation limestone), near the Cockscomb Range (granite, mid-high elevation), and at the northwestern edge of the Mountain Pine Plateau area (granite, high elevation). There were also similar patterns of moderate to high GHI with scattered hotspots in the far south of the country.

The north-eastern part of Belize was predicted as generally low GHI and did not reflect the hotspots shown in the preliminary bioquality map (based on observed data). The area of predicted low GHI along the coast towards the south was associated with the flat coastal plains/recent alluvial and littoral sediments. Predictions did not reflect any of the moderate - high GHI scores that occur near the coast in the preliminary bioquality map.

4.4 Discussion

The maximum GHI score predicted by the SSDM map was 404 which would seem realistic when compared to the maximum GHI score (352) recorded from RBS samples carried out in Belize in 2016 (see Appendix V). However, it is low in comparison to the maximum GHI score from the preliminary bioquality map (541). For comparison the highest GHI score recorded for Trinidad & Tobago (also from RBS samples in the field) was 669 (Baksh-Comeau *et al.,* 2016), and the highest score for Quintana Roo (Mexico) was 70 (Hawthorne & Hughes, 1997).

Predictions arising from the SSDM map suggest two main areas that should be considered as priorities for in situ data collection; the Maya Mountains (and into the Burgos Plateau), and the Vaca Plateau. Both these areas reflect observed data (the preliminary bioquality map). Two other areas of note on the SSDM map (that have insufficient data to appear on the preliminary map) are the high GHI scores that correspond with steep-sided valleys in the northwest of the country, and the thin band of high GHI running along the northern perimeter of the block of acid sandstones, shales & slates. If these areas are also predicted as hotspots by the macroecological modelling method (see Chapter 5), they should be considered as priorities for new data collection.

Despite poor prediction accuracy, the SSDM method shows promise as a means to predict GHI. The reliability of the SSDM map ultimately relies on the accuracy of the species distribution predictions. Previous studies have shown that binary SSDMs (where probability values are reclassified to represent presence/absence data) tend to over inflate species richness per unit area because species-level predictions do not account for macroecological constraints. In other words, the environmental conditions of an area may well be suitable for a species, but that does not necessarily mean it will occur there. It seems likely that the stack of species distribution models has predicted generous sub-regional species pools. As a topic for further work, if stacked species distribution models were to be improved in future, it would be important to filter local predicted species pools. One method of filtering (or constraining) predictions is to use a 'probability ranking rule' (D'amen *et al.,* 2015). The predicted species pool per unit area is filtered by removing taxa with the lowest probability of presence. The rule assumes that taxa with higher probability values (i.e. habitat suitability is high) have a competitive advantage. New R code would be required to automate the process. Probability values (the ten-percentile training presence threshold value) would need to be re-assigned to all taxa in each cell (these values are lost once raster files have been reclassified to binary) so that the probability ranking rule can be applied. D'Amen *et al*., suggest the target number of taxa per unit area should be determined using macro ecological models. Refinement of the modelling methodology is discussed in more detail in Chapter 6. However, over inflation of species richness need not be a problem for bioquality predictions if the proportion of species from different Stars were predicted correctly.

Data points for taxa that could not be modelled (due to low numbers of records) were manually added to the stack and therefore, those taxa contributed far fewer points to the final stack. This is likely to have resulted in lower GHI for some areas because the taxa that could not be modelled were mostly Black (some Gold) Star species (i.e. species that have a higher weight in the GHI calculations).

The mean AUC values suggest Blue Star models achieved the best predictive performance. Accurate predictions of the distribution of widespread species are challenging because their environmental tolerances cover a much wider range of values. Low numbers of occurrence records for rare taxa are also a recurring problem for SDM and it is difficult to produce reliable distribution maps. Limited data are unlikely to represent the full range of environmental conditions tolerated by a species. Species-specific fine tuning of models (in terms of Maxent settings) would perhaps produce better results but it is very time-consuming with large numbers of taxa. Modifying the extent of background data for each species (as was the case for Black Star taxa in this research) may produce better results in terms of species richness and GHI predictions. Environmental data layers could also be modified to exclude areas where habitat has been degraded or destroyed due to land use change. Recommendations for future research are presented in Chapter 6.

A bottom-up approach to modelling bioquality hotspots will always be challenging where data for Black Stars are scarce. A direct (or 'top down') modelling approach, where GHI is predicted as 'the whole' as opposed to the sum of its parts, may prove to be a better option because rare species (even those with only one or two occurrence records) can be included in the models. Chapter 5 explores the use of macroecological modelling to predict GHI across Belize.

CHAPTER 5

Macroecological modelling of bioquality

5.1 Introduction

In Chapter 4, a bottom-up approach to modelling community-level attributes was examined. An alternative strategy is top-down, macroecological modelling (hereafter referred to as 'MEM'), also referred to as 'assemble first, predict later' or 'classification then modelling' (Ferrier & Guisan, 2006) . This strategy is based on the view that a plant community is a distinct spatial entity; a fixed set of co-occurring species (Clements, 1916).

The community-level attribute of interest is usually derived from sample plot data via ordination or classification, or may simply be observed species richness. MEM treats the community level attribute as the response variable and relates this to the values of environmental variables that categorise the same geographic unit. MEM can be approached in several ways. Community types can be modelled individually by relating the observed presence or absence of that community type to the environmental predictor variables. This is similar to species-level modelling, in that the presence or absence of the community type is modelled and extrapolated across the area of interest. Macroecological attributes can also be modelled using techniques that relate a quantitative response variable to a set of environmental predictor variables using, for example, Generalised Linear Models (GLM), or Generalised Additive Models (GAM). GLM and GAM are commonly used to model species richness using numbers of taxa recorded per unit area from survey data (e.g. Jafarian & Jalil Alavi, 2018; Lobo *et al.*, 2004; Moser *et al.*, 2005).

One distinct advantage of macroecological modelling over stacking individual species models is the speed at which results can be produced. For the latter, a model must be fitted for each species and this becomes time consuming when dealing with large numbers of taxa. A second advantage is that MEM makes use of all available data, including taxa that have few occurrence points (which would be excluded from stacked species distribution models due to poor predictive performance at low sample sizes). It is therefore possible that the data for more common species may help to support the modelling of rarer species. In contrast, poor predictive performance of MEM may be due in part to the specialist requirements of rare species, meaning that individual models are more sensitive to these requirements, therefore leading to better predictions from the SSDMs (Chapman & Purse, 2011).

Community attributes for MEM are ideally derived from data collected via systematic sampling. Where such data are lacking, community attributes per unit area can be generated using herbarium data. Many studies have used herbarium specimens to estimate species richness, but relatively few have explored their reliability as a means of predicting species richness within a MEM framework. A major drawback is the incompleteness of sampling (particularly for the tropics), and bias in such datasets (Distler *et al.,* 2009). Even if species richness proves difficult to predict from herbarium data, there may still be potential to use these datasets to model community level characteristics based on relative proportions of different types of species, such as community types, or bioquality hotspots.

Objectives

To test the use of macroecological modelling as a means to predict bioquality hotspots.

5.2 Materials and methods

Data

Data for the analyses carried out in this chapter were extracted from the Belize vascular plant database. Methods for population and curation of the database are documented in Chapter 2. Data from 30 samples collected in Belize in 2016 (as part of this D.Phil. research) was excluded from models and used as an independent test dataset (to evaluate the accuracy of GHI predictions), together with data from 55 samples collected in Quintana Roo, Mexico. The Quintana Roo data were collected as part of a DIFD (Department for International Development) project (Hawthorne & Hughes, 1997). GHI data from Mexico were updated to reflect Star ratings for taxa in the database. New taxa (i.e. those not present in Belize but recorded in Quintana Roo) were added as necessary. For both Quintana Roo and Belize data, sampling procedures followed guidelines in Hawthorne & Marshall (2015).

Preparation of data points and environmental predictor variables

Nine environmental predictor variables were used for modelling based on the process detailed in Chapter 4. These variables were lithology (geology & soil), terrain ruggedness, topographic position, landform, aspect, maximum temperature of warmest month, minimum temperature of coldest month, precipitation of wettest month, and precipitation of driest month. Variables were selected based on the process detailed in Chapter 4. High-resolution data (30 arc-seconds, c. 1 km) were used as they were likely to produce better predictions for plants (Guisan & Thuiller, 2005). Data were formatted to the same geographic extent, and geographic coordinate system (World Geodetic System 1984 datum) using ArcMap 10.4.1 and/or QGIS Desktop 2.8.2.

GHI scores (data points for modelling; observed GHI) were generated from within the Belize vascular plant database. The 'diversity analysis' tool in BRAHMS classifies georeferenced botanical record into cells of a specified size and uses those data to calculate GHI (see Chapter 3 for sample GHI calculation). A grid of 1 km cells was selected for GHI calculations (equivalent to 30 arc-seconds, to match the resolution of the environmental data used for modelling). GHI calculations used all georeferenced botanical records (species and infra specific taxa) but excluded cultivated taxa.

Due to uneven sampling across Belize, some grid cells had very low numbers of botanical records. Data in these grid cells were unlikely to result in reliable GHI scores and were therefore excluded. The aim was to generate a dataset that would provide sufficient data points for modelling but to also ensure that GHI scores were reasonably reliable (i.e. sufficiently sampled grid cells). Three datasets were created with thresholds for minimum number of records set at 30 (dataset A), 40 (dataset B) and 50 (dataset C) records per 1 km grid cell (higher thresholds resulted in too few data points for modelling). Outliers were removed, and summary statistics were calculated for each dataset. A Pearson's product moment test was used to determine if there was a relationship between GHI and number of records per grid square. Results are shown in Table 5.1.

To investigate the effect of decreasing sample size on the predictive power of the models and on the accuracy of predictions from the final bioquality maps, models were fitted for all three datasets.

Model settings and evaluation

The GHI score for each 1 km grid cell was placed into one of seven classes, with each class representing a range of GHI values. The divisions for the classes follow those shown on the preliminary bioquality map (Chapter 1, Figure 3.2). Class 1 included GHI values of < 50; Class 2 included GHI values from 50 – 99; Class 3 included GHI values from 100 – 149; Class 4 included GHI values from 150 – 199, Class 5 included GHI values from 200 – 249, Class 6 included GHI values from 250 – 299, and Class 7 included GHI values of 300 and above. Each class was modelled separately. Modelling GHI in this way (as classes, or units, of values) allowed for a simple means of placing restrictions on the geographic extent of predictions (and therefore the selection of background points) via the use of 'mask files' (see below) that were specific to each GHI value class. Table 5.2 shows number of data points (samples) for each GHI value class. Table 5.3. shows the average Area Under the Curve (AUC) values (for test data, from Receiver Operating Characteristic graphs) for each of the GHI value classes in each of the three datasets.

Maxent (version 3.4.1) was selected for modelling. As with stacked species distribution models in the previous chapter, the most important criteria for model selection was the ability to achieve good predictive performance at low sample sizes (because Class 1 GHI values had few data points), the ability to handle presence-only data (i.e. the presence of a GHI score; a grid cell that had sufficient botanical records for GHI to be calculated), and the option to use categorical predictor variables.

In the previous chapter, for individual species models, mask files were used (i.e. a different geographic extent for Black, Gold, Blue and Green Star taxa) to restrict predictions to plausible occurrence limits of the species. To account for this within the MEM framework, low GHI (Class 1 & 2) was modelled with the geographic extent (mask file) that was used for Green Star taxa. Class 3 GHI scores were modelled with the same geographic extent that was used for Blue Star taxa. Class 4 and 5 scores were modelled with the Gold Star mask file. For high GHI (Class 6 and 7 ‘hotspots’) a mask file was created to represent the core area of occurrence for Black Star species (see ‘Material and Methods’ section in previous chapter). For each GHI class, the mask file also excluded grid cells where GHI scores from the six other classes were known, thus preventing Maxent from selecting those cells as background points (for explanation of background points, see previous chapter). Although not presented here, results with mask files were compared to those produced using the same geographic extent for all seven GHI classes. Restricting the geographic extent resulted in more accurate predictions when compared against the independent dataset.

Each GHI class was modelled with five replicates using cross-validation. All other Maxent settings were as per the default (for choice and justification of settings, see previous chapter). The predictive performance of each model was evaluated using the standard Maxent outputs; analysis of omission / commission graph, the receiver operating characteristic (ROC) curves and its associated AUC (area under the curve) value. The following guidelines for interpreting AUC were used: excellent (0.90–1.00), very good (0.8–0.9), good (0.7–0.8), fair (0.6–0.7), and poor (0.5–0.6) (Ren-Yan *et al*., 2014). AUC values for each group are shown in Table 5.3.

Stacking and reclassifying models

Maxent produces an ASCII file type for each replicate run, and a file for the average of all runs. The ASCII file displays the geographic area of interest as a grid of pixels, with each pixel containing a value ranging from 0 – 1, representing probability of presence. For each GHI group the average of the five replicate runs was selected. To create the final bioquality maps, ASCII files were stacked in R and reduced to a single raster layer by assigning each pixel to the GHI class with the highest predicted probability of occurrence. Results from the three datasets were mapped in ArcMap.

Testing predictions

An independent dataset (observed GHI derived from plot sampling) was used to evaluate the accuracy of the predictions. GHI from the independent dataset was mapped and overlaid onto the GHI predictions to determine the degree of correlation between them. The map that generated the most accurate predictions is shown in Figure 5.1.

Patterns in GHI

Predictions arising from the final MEM method (Figure 5.1) were examined in relation to underlying geology, elevation and terrain ruggedness (Table 5.4 and 5.5).

The final MEM map was compared against the preliminary (observed data) bioquality map presented in Chapter 3 (Figure 3.2) and against the SSDM map of GHI predictions presented in Chapter 4 (Figure 4.2) to determine where distribution patterns in GHI were similar.

Finally, the three maps were overlaid in ArcMap and examined for overlaps in areas where there were hotspots. Results are shown in Figure 5.2.

5.3 Results

Summary statistics for three datasets

There was no significant correlation between number of records per grid cell and GHI in any of the three datasets (see Table 5.1). Dataset B was the closest to normal distribution in terms of skewness and resulted in sufficient samples for each GHI score range group, for modelling (see Table 5.2).

Table 5.1. Summary statistics for the comparison of three GHI datasets, and p-values for Pearson's product moment test for correlation between number of records per grid cell and GHI. Dataset A included all 1 km grid cells with a minimum of 30 records per grid cell; dataset B included all 1 km grid cells with a minimum of 40 records per grid cell; dataset C included all grid cells with a minimum of 50 records per grid cell.

Dataset	Samples	Standard error	Standard deviation	Skewness	p-values
A	350	5.511	103.106	1.039	0.3351
B	253	6.129	97.497	0.725	0.3197
C	190	6.939	95.657	0.789	0.5418

Table 5.2. Number of samples (data points) per GHI value class, for each of the three datasets.

Dataset	Class 1 (<50)	Class 2 (50 – 99)	Class 3 (100 – 149)	Class 4 (150 – 199)	Class 5 (200 – 249)	Class 6 (299 – 300)	Class 7 (>300)
A	11	23	58	75	64	42	59
B	7	20	43	55	44	32	44
C	3	11	29	40	41	26	35

Predictive performance of models

Table 5.3 shows the AUC values for each GHI group model, for each of the three datasets. All AUC values were within the 'excellent' or 'very good' range in terms of predictive performance. Increasing the number of data points available for modelling did not consistently increase or decrease AUC values. Dataset B (minimum threshold of 40 records per 1 km grid cell) had the highest AUC values for four of the seven models and was the most accurate in terms of predicting GHI scores from the independent dataset. The final bioquality map for this dataset is shown in Figure 5.1. A total of 50 (58%) observed GHI scores were correctly predicted. Of the 35 incorrect predictions, 25 were one or two classes lower than observed GHI scores and 10 were one or two classes higher than observed GHI scores, suggesting a tendency to under-predict GHI scores.

Table 5.3. Average Area Under the Curve (AUC) values (for test data, from Receiver Operating Characteristic graphs) for each of the seven GHI value classes in each of the three datasets.

Dataset	Class 1 (<50)	Class 2 (50 – 99)	Class 3 (100 – 149)	Class 4 (150 – 199)	Class 5 (200 – 249)	Class 6 (299 – 300)	Class 7 (>300)
A	0.911	0.983	0.982	0.965	0.957	0.958	0.982
B	0.821	0.960	0.986	0.970	0.971	0.966	0.982
C	0.939	0.85	0.982	0.959	0.951	0.967	0.98

For dataset A (minimum threshold of 30 records per 1 km grid cell), the resulting bioquality map (not shown) correctly predicted 39 (46%) observed GHI scores. Of the 46 incorrect predictions, 31 were either one, two, three or four classes higher than observed GHI scores and 15 were one class lower than observed GHI scores, suggesting a tendency to over inflate GHI (slightly less so than the dataset with a minimum threshold of 50 records per grid cell). It is possible that the additional grid cells (those with 30 – 39 records) have not been sufficiently sampled to provide reliable GHI.

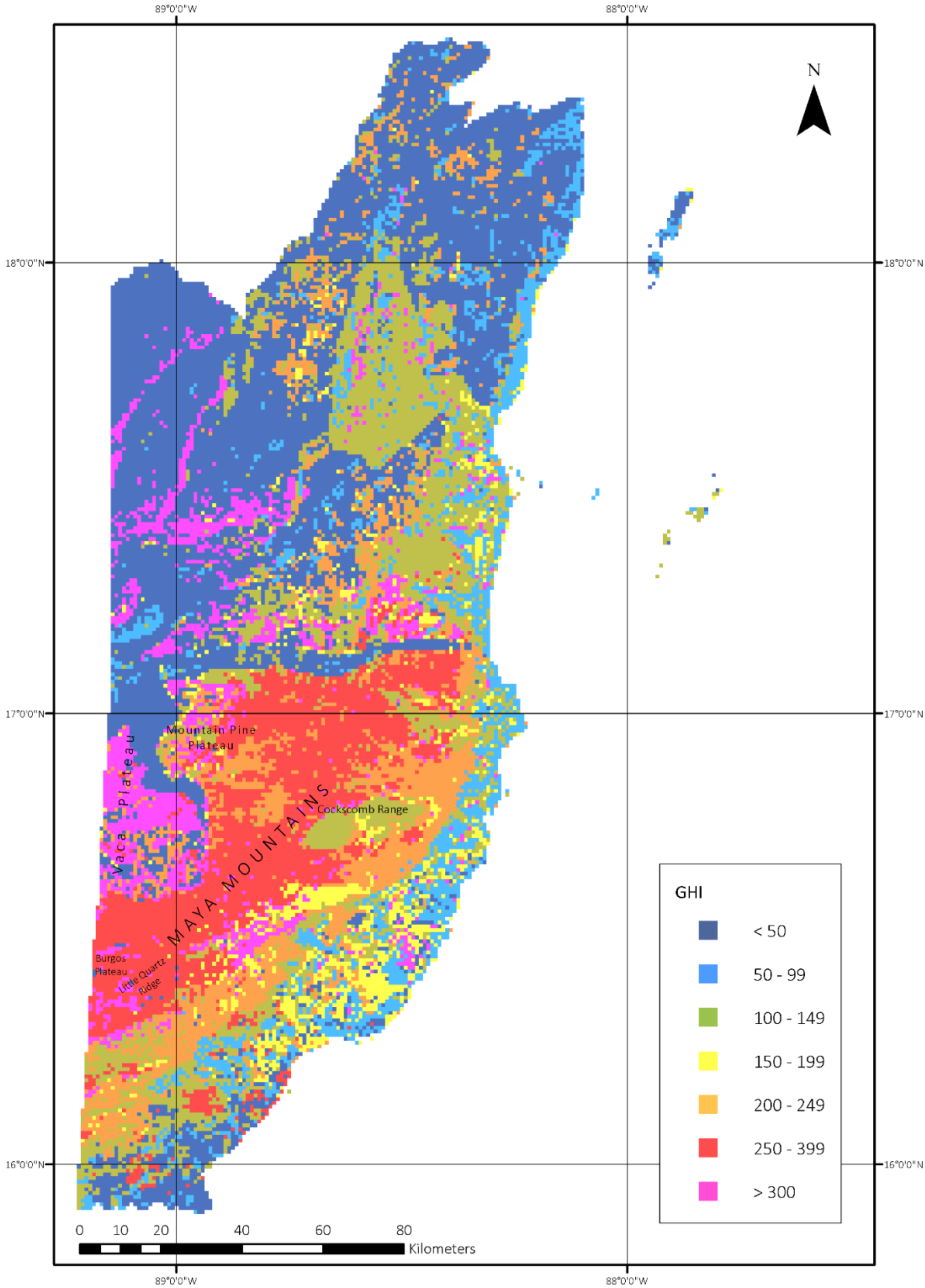
For dataset C (minimum threshold of 50 records per 1 km grid cell), the resulting bioquality map (not shown) accurately predicted a total of 39 (46%) observed GHI scores. Of the 46 incorrect predictions, 42 were one, two, three or four classes higher than observed GHI scores and four were one or two classes lower, suggesting a tendency to over inflate GHI. Relative to the other two datasets, this dataset had a higher proportion of data points with high GHI. Only three sample cells had the lowest (Class 1) GHI values. Although previous studies have suggested three sample points are insufficient for modelling, the AUC value (0.939) suggests excellent predictive performance and in the final bioquality map, all Class 1 test points (from the independent dataset) were predicted correctly.

The most important (i.e. contributed more to the 'gain' of the model, see Appendix IV for further explanation) environmental predictor variables across all three datasets were Bio5 (maximum temperature of warmest month), Bio14 (precipitation of driest month from the WorldClim dataset) and lithology (from the World Ecological Land Units dataset). In dataset B (the most accurate in terms of predicting the test data), Bio5, Bio6 (minimum temperature of coldest month) and Bio 14 were the most important variables in the models for the low GHI classes (<150). Lithology, Bio5 and Bio14 were more important in the models for the higher GHI classes (<200).

Patterns in GHI predictions

21% (5,618) of grid cells on the map in Figure 5.1 were predicted to have GHI >250 (hotspots).

Figure 5.1. A map of bioquality predictions for Belize, produced using the MEM method. GHI was predicted at a resolution of 1 km x 1 km using Maxent (version 3.4.1). GHI data points were generated from the Belize vascular plant database using 1 km x 1k m grid cells containing at least 40 botanical records.



Results from the MEM method (Figure 5.1) predicted the Maya Mountains and surrounding areas as uniformly high – moderate GHI (except for the area around the Cockscomb Range). High GHI was also predicted along two strips (associated with steep-sided valleys) in the north east of Belize, and an area just below this where the limestone meets the recent alluvial and littoral sediments. There were also scattered hotspots towards the northeast, and along the coast towards the south of the country. The MEM predictions were examined in relation to geology, elevation, and terrain ruggedness (see maps in Chapter 3, Figure 3.2, 3.3 and 3.4). Table 5.4 shows that the highest number of hotspots were associated with the acid sandstones, shales & slates, the high elevation range, and the highly rugged terrain class.

Table 5.4. Number (and percentage) of grid cells in Figure 5.1 that were predicted to have GHI >250 for each of the six geological substrata, for each of the three elevation ranges, and for each of the four terrain ruggedness classes.

	Number of grid cells with GHI >250	% of grid cells
Geological substrate		
Acid sandstones, shales & slates	2364	42
Granite	266	5
Limestone	2178	39
Recent alluvial & littoral sediments	378	7
Calcareous sandstones & shales	173	3
Volcanic	259	5
Elevation range		
Low (0 – 300 m)	1733	31
Mid (300 – 600 m)	1777	32
High (> 600 m)	2108	38
Terrain ruggedness class		
Level	1102	20
Slightly rugged	2134	38
Moderately rugged	1604	29
Highly rugged	778	14

Due to the differences in surface area occupied by each geological substrate (or elevation range, or terrain ruggedness class), grid cells with GHI >250 were examined as a percentage of the total number of grid cells associated with each substrate (and elevation range, and terrain ruggedness class). Table 5.5 shows that volcanic substrate, the high elevation range, and the highly rugged terrain class had the highest number of hotspots relative to total surface area.

Table 5.5. Number (and percentage) of grid cells in Figure 5.1 with predicted GHI >250, relative to the total number of grid cells associated with each of the six geological substrata, each of the three elevational ranges, and each of the four terrain ruggedness classes.

	Total number of grid cells	Number of grid cells with GHI >250	% of grid cells with GHI >250
Geological substrate			
Acid sandstones, shales & slates	3707	2364	64
Granite	961	266	28
Limestone	12264	2178	18
Recent alluvial & littoral sediments	7217	378	5
Calcareous sandstones & shales	1777	173	10
Volcanic	319	259	81
Elevation range			
Low (0 – 300 m)	20773	1733	8
Mid (300 – 600 m)	3091	1777	57
High (> 600 m)	2381	2108	89
Terrain ruggedness class			
Level	17420	1102	6
Slightly rugged	4957	2134	43
Moderately rugged	2842	1604	56
Highly rugged	1026	778	76

Comparison of GHI distribution patterns between the MEM map and the preliminary bioquality map

Predictions from the MEM map are consistent with GHI shown in the preliminary (observed data) bioquality map (Chapter 3, Figure 3.2) in several areas. The most obvious similarities are the areas of high GHI (>250) at the southern end of the Maya Mountains (Little Quartz Ridge & Burgos Plateau), much of the Mountain Pine Plateau, and the eastern side of the Maya Mountain Divide. Hotspots on the Mountain Pine Plateau are associated with an area of sub-montane pine forest/pine savanna (see ecosystem map in Chapter 1, Figure 1.3).

MEM predictions are also consistent with the preliminary GHI map in the north eastern part of Belize (low GHI, with scattered scores of >200). This pattern of low GHI continues towards the northwest. Comparison with the ecosystem map reveals high GHI scores are associated with lowland savanna. Eighteen of Belize's 41 endemic species are found in lowland savanna according to Goodwin *et al.,* (2013). Hotspots in lowland savanna in the south are also consistent between the two maps. Predictions suggest that northern savanna is slightly hotter (i.e. higher GHI) than southern savanna. Of the data points used for modelling, those associated with lowland savanna in the northern half of the country have a mean GHI of 218, while those in the south have a mean GHI of 134. This indicates a difference in species composition between northern and southern savannas, with more globally rare (Black and Gold Star) taxa in the north. Differences in species composition may be due in part to differences in soil. In the north, savanna is found on paleo-alluvial deposits eroded from the Maya Mountain Massif and from ancient littoral deposits (Wright *et al.,* 1959) whereas savannas in the south are found on sands and gravels deposited (much more recently) from mountain streams. The north – south rainfall gradient may also affect species composition, as savannas in the south receive more rainfall than those in the north.

Comparison of GHI distribution patterns between the MEM map and the SSDM map

The MEM method predicted a higher percentage (21%) of hotspots (grid cells with GHI of >250) than the SSDM method (12%).

The thin diagonal bands of high GHI in the northwest on the MEM map in Figure 5.1 show a similar pattern to those in the SSDM map (although grid cells on the latter had slightly lower GHI). According to the elevation map these areas are associated with steep sided valleys (on limestone). Both maps show cells within the central portion of the Vaca Plateau (limestone; c. 400 – 700 m; low – slightly rugged terrain, with highly rugged terrain at the southern end), and much of the Burgos Plateau (limestone, c. 800 m; relatively flat terrain) as high GHI (slightly lower overall in the SSDM map). Both maps show high GHI at the western end of Little Quartz Ridge (as it descends to the Burgos Plateau), and in the limestone foothills (highly rugged terrain) on the eastern side of the Maya Mountain Divide. Generally, GHI on limestone gradually declines towards the far south of the country on both maps. In the far north of Belize, both maps show patchy hotspots (more obvious in the MEM map because the surrounding cells are low GHI, whereas the SSDM map generally predicts higher GHI across this area).

The most striking difference between the MEM map and the SSDM map is the area along the northern perimeter of the acid sandstones (where it meets the limestone). The MEM map shows an almost solid band of low GHI, whereas the SSDM map shows a band of high GHI. There are insufficient data points in this same area on the preliminary bioquality map to determine whether the MEM method or the SSDM method has produced the most reliable prediction. The block of acid sandstones, shales & slates are predicted to have mostly moderate – high GHI on the MEM map, but much lower GHI on the SSDM map. Again, there are insufficient data points on the preliminary bioquality map (observed GHI) to determine which version was likely to be more reliable. The oval-shaped granitic intrusion (within the acid sandstones) is predicted to have low – moderate GHI (100 – 200) using the MEM method, but moderate – high GHI (>200) using the SSDM method. The preliminary bioquality map shows low – moderate GHI, suggesting that the SSDM map was more reliable. The MEM method predicts the Maya Mountain Divide as almost uniformly high GHI, whereas the SSDM method predicts a mosaic of scores ranging from 100 – 200, with scattered hotspots at the southern end. The preliminary bioquality map has very few data points close to the Divide, therefore it is difficult to determine which version of the predictions is likely to be more reliable.

Comparison of GHI distribution patterns in the MEM, SSDM and preliminary (observed GHI) maps

The highest percentage of hotspots are associated with the acid sandstones, shales and slates on the MEM map, but with limestone on the SSDM map and the preliminary (observed GHI) map. The highest percentage of hotspots are associated with the high elevation range on the MEM map, but with the low elevation range on the SSDM map and the preliminary (observed GHI) map. The highest percentage of hotspots are associated with slightly rugged terrain on the MEM map and SSDM map, but with level terrain on the preliminary (observed GHI) map.

Figure 5.2. Comparison of hotspot predictions. Coloured cells show predicted hotspots (GHI > 250) from the MEM method, the SSDM method, and preliminary GHI (observed data). Overlaps between MEM predicitons and SSDM predictions are shown in dark red. Observed data are shown in green. This map does not display cells where GHI <250.

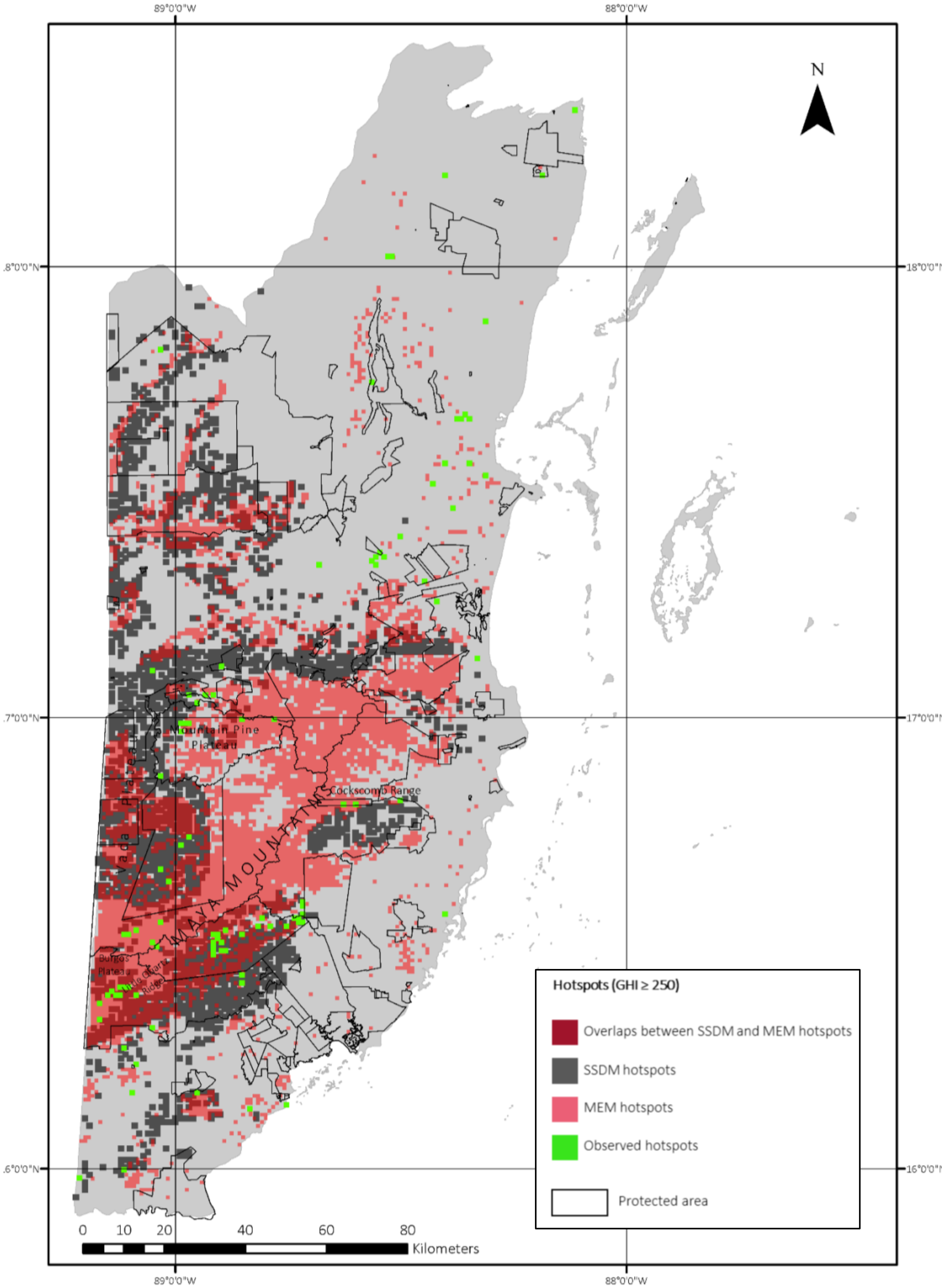


Figure 5.2 shows that most of the overlaps between the MEM and SSDM hotspot predictions are found in a diagonal band of grid cells running along the Maya Mountains (which continues towards the Burgos Plateau), and in an area close to the western border with Guatemala, on the Vaca Plateau. Hotspots from the preliminary map overlap with both the SSDM and the MEM predictions on the eastern side of the Maya Mountains, and near the Burgos Plateau.

5.4 Discussion

The main areas where hotspots (GHI >250) overlap on the two maps of GHI predictions (SSDM and MEM) represent potential areas of high conservation value. These areas should be considered as priorities for in situ sampling:

1) The western end of the Colombia River Forest Reserve, including Little Quartz Ridge and the Burgos Plateau.
2) On the Vaca Plateau, near the border with Guatemala and eastwards into the Chiquibul Forest Reserve.
3) The limestone foothills on the eastern side of the Maya Mountains, in the Bladen Nature Reserve.

These areas are discussed in the context of conservation and protected area management in Belize in Chapter 6.

Results presented in this chapter demonstrate that macroecological modelling of GHI using Maxent is a reasonably reliable means of predicting bioquality at high (1 km) resolution. The accuracy of predictions could no doubt be improved with the addition of more data. When directly modelling GHI as GHI value classes, it is necessary to have not only enough data points to model for each GHI value class, but also to ensure (as much as possible) that GHI scores are reasonably reliable in the first place (i.e. derived from grid cells that have been sufficiently sampled). For a database largely comprised of herbarium specimens, GHI (and the resulting predictions) are undoubtedly affected by inventory incompleteness and sampling bias. This reinforces the need for a coordinated approach to data collection across Belize via systematic sampling across the whole flora, and in under-collected areas.

Although the MEM map was better at predicting the test dataset, both maps show affinities with the preliminary GHI map (observed data), although not always in the same area. Neither version paints an entirely plausible picture of bioquality across the whole of Belize (based on what is already known about the flora from previous research). It is possible that a combined version, whereby species richness predictions are constrained using macroecological predictions could produce a more convincing (and accurate) result (see 'Refinement of modelling methods' in Chapter 6).

Strengths and weaknesses of the methods

The speed at which results (bioquality maps) can be produced is an important consideration for conservation planning. Assuming no sample plot data are already available for MEM, the process of collating and cleaning herbarium data (to then calculate GHI from botanical records, or to use botanical records for individual species distribution models) is the same for both methods. The modelling process itself is far quicker for MEM. Once models are complete, MEM requires very little post-model processing compared to the SSDM method presented in Chapter 4. The MEM method presented in this chapter is a relatively rapid means of predicting bioquality that could be particularly useful if a protected area (or portions of it) is facing imminent de-reservation or downgrading.

Both methods require a comprehensive database of botanical records (assuming sample plot data are not available for MEM) and accepted names. Assembling a database (even for a country the size of Belize) requires considerable time and effort and at least a basic knowledge of taxonomy and nomenclature. However, if the Belize database used for this research is regularly maintained (and continuously updated), extracting subsets of data for smaller areas would be a relatively quick and simple process.

CHAPTER 6

Conclusions

6.1 Summary of results

The checklist of 3,941 accepted names (species and infra specific taxa, presented in Appendix II) recognises an additional 21 families, 168 genera, 196 species, and 208 infra-specific taxa from those listed by Balick *et al.,* (2000).

The flora of Belize is well-collected relative to other countries in the region but there is clear evidence of collecting bias. Analysis of data using the Chao1 equation estimates a total flora of 4,746 species and suggests that six of the seven habit groups have reached over 80% sampling completeness. Trees and palms are the most well documented groups and are likely to be close to sampling completeness. Future collecting should focus on epiphytes, although data from a recent inventory (see below) will no doubt improve the current figures for sampling completeness for this component of the flora.

The distribution of botanical records collected across Belize (sampling effort) is uneven, with a bias towards research stations, major roads, settlements and distinctive geomorphological features. Limestone has received the most attention in terms of number of records (and associated published studies), and Chao1 estimates of species richness suggest that 76% of the limestone flora has been documented. The volcanic substrate, although covering the smallest area relative to the other substrates, is the least collected (62% of the flora already documented). The north of Belize is more sparsely collected than the south. There is a distinct gap in collections towards the centre of the country, which corresponds to the acid sandstones, shales & slates. The botanical records collected on this substrate are mostly confined towards the west of the country, at higher elevations. Future data collection should ideally seek to fill these gaps, thereby redressing historical bias.

Over half the flora of Belize is comprised of taxa that have a widespread Neotropical distribution. Only 3% of the flora is made up of taxa that are globally rare (Black Stars). Although this research confirms that endemism in the flora of Belize is low (Balick *et al,* 2000; Brewer *et al.,* 2003), there are likely to be bioquality hotspots in Belize and their distribution is affected by geological and topographic diversity. Observed GHI, and GHI predictions from two modelling methods, suggest that parts of the Maya Mountains and immediately adjacent areas are likely to have high GHI relative to other parts of the country.

This research demonstrates that observed GHI data (calculated from botanical records) and GHI predictions are a useful starting point for protected area managers and conservation practitioners in terms of prioritizing areas for further research. In view of bias and gaps in the Belize vascular plant dataset, conservation decisions and actions (e.g. expansion of a protected area) should not be based solely on observed GHI or predicted GHI.

The macroecological modelling method (MEM) resulted in predictions that were more reliable than those from the stacked species distribution modelling (SSDM) method (based on comparison with the independent test dataset). Each method had its own strengths and weaknesses in terms of practical execution. The MEM method has the distinct advantage of being far quicker than the SSDM method (assuming that a database of records is available, and data have been cleaned).

When the maps from the two modelling methods (MEM and SSDM) were combined, three potential high conservation value areas were identified. These should be considered priorities for in situ data collection:

1) The western end of the Colombia River Forest Reserve, including Little Quartz Ridge and the Burgos Plateau.
2) On the Vaca Plateau, near the border with Guatemala and eastwards into the Chiquibul Forest Reserve.
3) The limestone foothills on the eastern side of the Maya Mountains, in the Bladen Nature Reserve.

See below for discussion of these areas in the context of conservation and protected area management in Belize.

6.2 Endemism hotspots in the flora of Belize

The Maya Mountain Massif (see Figure 6.1) has already been identified as a Key Biodiversity Area (see Chapter 1); an area of high conservation value for Belize, and for the Central American region. Results from analyses of vascular plant data using the RBS framework strongly support this designation. Observed GHI and GHI predictions from modelling methods indicate high bioquality within the Maya Mountain Massif relative to other parts of Belize. The complex mosaic of underlying geology, in combination with topographic diversity, results in a heterogeneous landscape of habitats. Isolated patches of habitat within this landscape may explain the high concentrations of endemism (Gentry, 1992). Some of these habitats are likely to act as ecological islands and as such, are of high conservation value, not only to Belize, but also for the region. Similar habitats that once existed in other parts of Central America have been severely degraded, whereas the forests of the Maya Mountains are, by comparison, still relatively intact (Meerman & Matola, 1997).

Balick *et al*., (2000) suggested the endemics of Belize should be analysed in the context of phytogeographic regions (see 1 – 5 below). All three bioquality maps (observed GHI, MEM and SSDM predictions) showed high bioquality across much of (1) the lower montane wet & moist forests of the Maya Mountains, and (2) in the higher elevation montane forests of the Maya Mountains (although the SSDM map only predicted high GHI towards the southwest). All three maps predicted scattered hotspots within (3) forests on soils derived from metamorphic and igneous rocks of the Mountain Pine Ridge. Two of the bioquality maps (observed GHI and MEM predictions) show scattered hotspots within (4) forests on limestone of the Petén and northwestern Belize, and on (5) the coastal plains of the southern Mexican Yucatán and Belize.

Two of the bioquality maps (observed GHI and SSDM predictions) indicate that a high number of bioquality hotspots (GHI >250) are associated with limestone substrata. These areas include the lowland broadleaf wet forests on the rugged limestone hills of the eastern side of the Maya Mountain Divide, and the lowland broadleaf moist forests on the central portion of the Vaca Plateau, near the border with Guatemala. These results support the findings of a recent expedition that identified the karst limestone foothills of the southeastern elevations of the Maya Mountains as having high concentrations of endemic species (Brewer *et al.,* 2013).

Areas where underlying geology transitions from one substrate to another are also important for bioquality hotspots, notably the submontane broadleaf wet forests at the western end of the Maya Mountain Divide (where the volcanic substrate meets limestone), around Little Quartz Ridge. All three bioquality maps are consistent in showing an area of high GHI around Little Quartz Ridge, which supports Walker & Walker's (2009b) suggestion that the flora of this area is composed of species with restricted ranges.

6.3 Implications for conservation and protected area management in Belize

Hotspot predictions that are consistent between the SSDM and MEM maps (and which are supported in many cases by observed GHI) are located in some of Belize's least-protected (in terms of on-the-ground management) areas.

The ecosystem map (Chapter 1, Figure 1.3) shows agricultural land at the western border, on the Vaca Plateau, encroaching into Chiquibul National Park. Cross-border incursions are known to be a problem in this area. Chicas *et al.,* (2016) reported deforestation in this area, and the need to secure protected areas along the border. Further inland, hotspots were predicted in parts of the Chiquibul Forest Reserve. Forest Reserves in Belize permit timber extraction, and many have active logging concessions, including the Chiquibul Forest Reserve. The effects of selective logging on bioquality in the forests of Belize are not known.

The Burgos Plateau and Little Quartz Ridge are within the boundaries of Columbia River Forest Reserve, as are a portion of the limestone foothills on the eastern side of the Maya Mountain Divide. Columbia River Forest Reserve has repeatedly been highlighted as one of the most important biodiversity areas in Belize (e.g. Meerman & Matola, 1997; Walker & Walker, 2009b). This research suggests that the western end of the reserve has high bioquality. Despite several versions of a management plan, there is still no active management in place. The southeastern perimeter of Columbia River Forest Reserve is also of concern due to the expansion of farmland for subsistence agriculture adjacent to human settlements. In the past, slash and burn practices have led to wildfires which have severely degraded the vegetation in the limestone foothills. The bare limestone is still visible from the roadside today.

The vast majority of lowland savanna has no protected status in Belize. The small amount that is contained within protected areas is largely confined to three forest reserves in the south of the country. Based on the MEM map, lowland savanna in the north (which forms an arch around the perimeter of the Crooked Tree Wildlife Sanctuary) might support higher GHI than lowland savanna in the south and should therefore be a priority for protection. Although hotspots in lowland savanna were not predicted consistently by the two modelling methods, previous research has clearly demonstrated the importance of this ecosystem for endemic species.

The Mountain Pine Plateau area requires further investigation. Results presented here hint at hotspots within this area, but the modelled predictions do not match sufficiently to give much confidence in where hotspots might be. Most of the plateau is within the Mountain Pine Ridge Forest Reserve which has active logging concessions in place.

Bladen Nature Reserve has the highest level of protection in the national protected area system. On the ground, it is likely to be the best protected, as there are regular ranger patrols throughout the eastern side, and three to four patrols per year into the western side (pers. Comm. Ya'axché Conservation Trust, 2018). A large portion of the limestone foothills (which are predicted to have high GHI, supported by actual observations) are within Bladen Nature Reserve.

If new models (and subsequent field testing) confirm predicted hotspots, the recommendation (which aligns with the revised National Protected Areas System Plan) would be to extend 'nature reserve' status to include the western part of Colombia River Forest Reserve. This would place Little Quartz Ridge, the Burgos Plateau, and a greater portion of the southern limestone foothills under a higher level of protection. However, upgrading the protected status of forest reserves (in Belize, entry to nature reserves is restricted to research and education purposes) is likely to be contentious due to existing (or potential) logging concessions.

Hotspot maps should not ultimately lead to areas of low bioquality being 'written off' because they are of no value in the context of local, national or global conservation. Areas of forest with low GHI/high species richness (depending on species composition) are, in many cases, suitable for the sustainable extraction of non-timber forest products. These areas could form buffers around areas of high conservation value.

6.4 Refinement of modelling methods

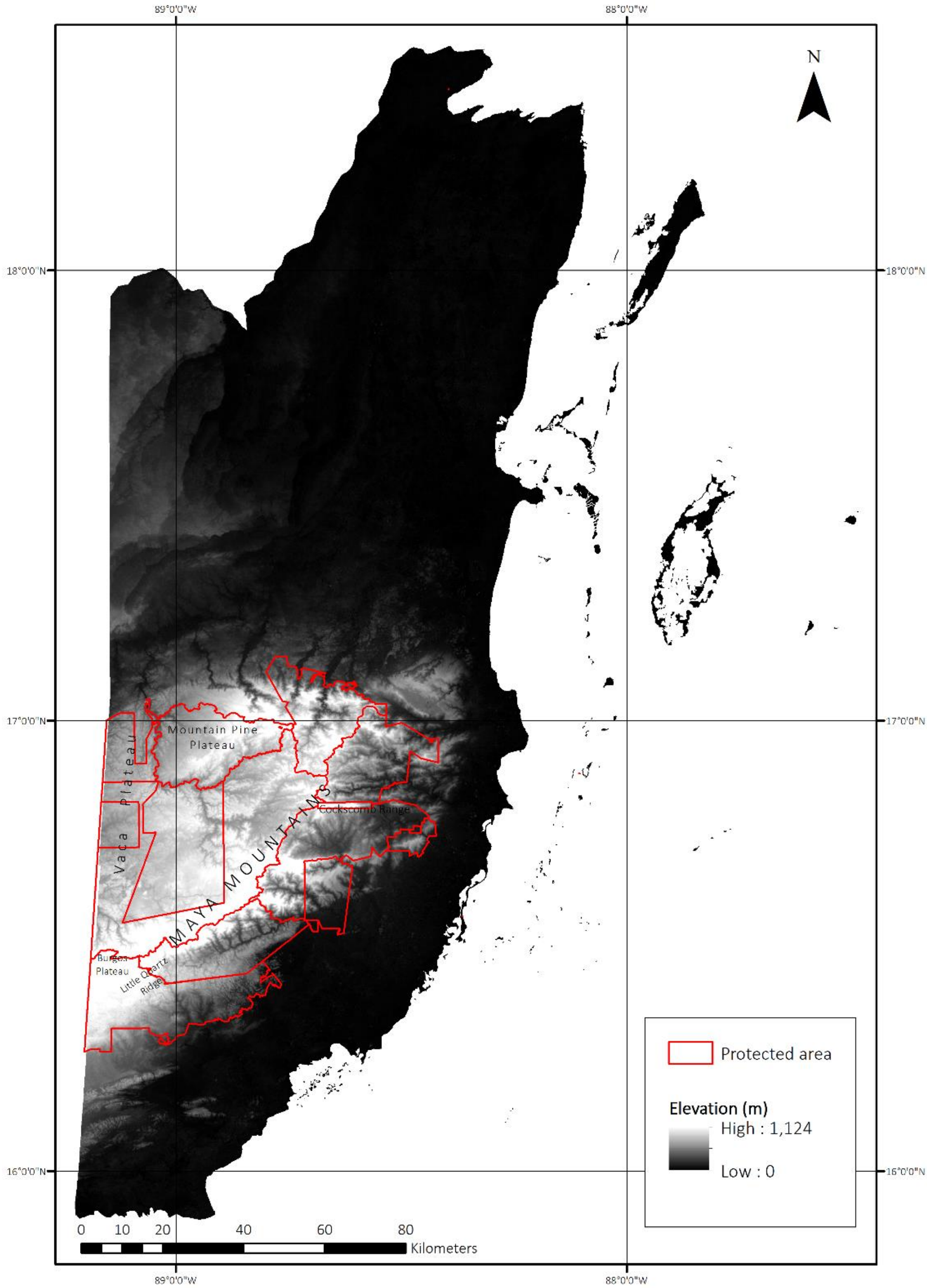
The modelling methods presented in this thesis show potential as a means of reliably predicting GHI at high resolution but there is certainly room for improvement. The Maya Mountain Massif (see Figure 6.1) was identified as a Key Biodiversity Area in 2007, using IUCN categories (see Chapter 1). The results of this research suggest that some areas of the massif do (and other areas are likely to) support vegetation with high GHI. Refinement of the methodology should therefore focus on this area. The recommendation is to re-do individual species distribution models (using default settings in Maxent), but to modify the extent of the background (environmental) data for each species individually, as the basis for refined predicted species lists (per unit area) and bioquality maps. Modification should incorporate data from recent land-use/land cover change maps. Species distribution models need to be fully automated (or as much as possible) using R. This would significantly speed up the pace at which bioquality maps can be produced, particularly if the development of R code reduces the need to physically check the results for each species. For example, R would generate a list of AUC values from the sensitivity/specificity analysis, and a list of values for the omission/commission analysis, so that the user knows, at a glance, which models need to be improved. It would also be useful if R could generate a list of the variables, in order of importance as defined by the standard Maxent analyses.

Raw probability maps would be stacked, and species lists per grid cell would be constrained based on macroecological predictions of species richness (predicted as a continuous numerical variable). For this part of the methodology, R code is required to take the data generated by the macroecological model (numerical values for predicted species richness per grid cell), go through each grid cell across the area of interest and extract the required number of taxa (based on the highest-ranking probability values), until the required total is reached.

If the reliability of GHI predictions can be improved, results from the SSDM method might prove more useful than a MEM approach to modelling GHI, because SSDM retains species level data. This would mean that GHI could be calculated for different components of the whole flora (e.g. habit type, or for a particular taxonomic group). For example, it would be interesting to know whether areas of high conservation value (based on GHI) are different if only tree taxa are considered.

The ultimate test of models would be via sampling in the field, first targeting areas that are predicted to have high GHI, but little or no observed data. Top priority for field sampling would be areas where predicted hotspots are outside of protected areas. Data collection would ideally employ the RBS plotless sampling method, so that the whole flora is sampled. This is challenging, particularly in Belize where capacity for field identification of plants is still very limited. The ability to identify plants across the whole flora (either in the field, or in herbaria) is an important consideration (limited knowledge of the flora among the field team significantly slowed the progress of this research). However, documenting the whole flora at sample sites would make a valuable contribution to filling the gaps in data for habit groups identified in Chapter 2. In the longer term, if prediction accuracy can be improved, the methodology could be presented via a more user-friendly interface, as a prioritisation tool for protected area managers. Managers could obtain data from a centrally maintained database of vascular plants (see below).

Figure 6.1. The Belize section of the Maya Mountain Massif, shown in relation to protected areas. High resolution data (1 arc-second) are from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM), available to download at https://earthexplorer.usgs.gov/



6.5 Research contributions: Towards a national strategy for plant conservation

This research (particularly the curation of the Belize vascular plant database) makes a valuable contribution to understanding the plant diversity of Belize and therefore towards achieving Objective 1 of the Global Strategy for Plant Conservation (CBD, 2018): *'Plant diversity is well understood, documented and recognised'.* The process of assigning species to Stars effectively prioritises species (Black Stars) that require a full conservation assessment using IUCN Red List categories and criteria, therefore contributing towards achieving Objective 1, Target 2: *'An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action.'*

The database of vascular plants curated for this research is the most comprehensive database compiled for the country to date and, if regularly updated in line with new collections and taxonomic revisions, should continue to be an extremely valuable resource for Belize. In the last five years, several new botanical research and/or monitoring projects have been established in Belize. In 2012, Ya'axché Conservation Trust began a vegetation monitoring programme in the Bladen Nature Reserve, with the establishment of two one-hectare permanent sample plots. Marie Selby Botanical Gardens (USA) have collaborated with Caves Branch Botanical Gardens (Belize) and the Environmental Research Institute (Belize) on an epiphyte inventory across the country. Wild Earth Allies supports the 'Trees of Belize' project. Commencing in 2016, it is a multi-year effort to build capacity for tree conservation and to produce a field guide to the tree species of Belize. These projects have already led to new records for the country, and the discovery of at least one species new to science. Data from these projects will be incorporated into the Belize database. The database has been discussed via a meeting of the Belize Herbarium Working Group and will be handed over to the Environmental Research Institute (University of Belize) in 2019 for ongoing curation. Ideally, it will eventually be accessible online, with data available to download[12].

It would be an onerous task to attempt to address certain errors in a database of this size, particularly where botanical records have been misidentified, or names have been misapplied.

[12] There are also plans for a 'Star database' (all taxa that have so far been placed into one of the four Star categories) to be made available online (pers. comm. William Hawthorne, 2018).

For large national & regional databases, data mining via the internet is problematic because individual specimens are not examined. For the Belize database, regular updating of species determinations whenever a revision is published should keep these errors to a minimum. It is likely that data sourced from Missouri Botanical Garden is the most accurate in terms of species determinations, due to their ongoing work on *Flora Mesoamericana* (Davidse *et al.,* 1994-). Data from the Natural History Museum London is considered similarly reliable due to the ongoing work and expertise of Caroline Whitefoord who has worked at NHM since 1953 and has collected in Belize since 1973. Data from the Royal Botanic Garden Edinburgh (RBGE) is considered reliable for some taxonomic groups, e.g. grasses (see Sylvester, 2017), and for savanna species and secondary forest species, as a result of two Darwin-funded projects (Project 14025 'Developing integrated assessment of biodiversity in secondary forest in Belize'; Project 17022 'Conservation of the lowland savanna ecosystem in Belize'). Belize material at RBGE has benefitted greatly from the input of botanist Zoë Goodwin who worked on both projects between 2005 and 2012, and more recently on a Sibbald Trust project that consolidates 16 years of RBGE's research and botanical training in Belize (see below).

The consolidation of Belize's existing plant data, together with identification of gaps in knowledge, and the prioritization of species and hotspots presented in this thesis sets the stage for development of a national strategy for plant conservation. The core of the national strategy would ideally be a list of important (in terms of high conservation value) species, habitats, and areas. High conservation value species would include Black Stars (because they are globally rare), as well as species that have been assessed as 'Critically Endangered' or 'Endangered' using IUCN Red List categories and criteria. The Star list is already very useful in its own right, in that it is a good starting point for prioritizing taxa most in need of IUCN Red List assessments. Currently, of the 3,941 names recognized by this study, only 291 have been assessed using IUCN Red List categories and criteria (239 of which were assessed as 'Least Concern' or 'Data Deficient').

Bioquality hotspot predictions (if confirmed by in situ data collection) would be used to define areas that are important for globally rare plants. The Important Plant Areas (IPA) approach for defining areas of conservation value has not yet been utilized in Belize. Although it is more widely recognised than the Rapid Botanic Survey (RBS) framework, the definition of an IPA partly[13] relies on plants from the national checklist having been assessed (globally) using IUCN Red List categories and criteria. Currently, only 7% of Belize's vascular plant species have been assessed.

A national strategy would ideally also include actions for species that are used, and/or culturally valuable. Balick *et al.,* (2000) included information on plant uses in their checklist. Updating this to include new names (i.e. those accepted for this research) would not be a difficult task. Incorporating conservation actions for commercially valuable species, particularly timber, presents a challenge because implementing those actions would likely be the responsibility of private logging companies, and would also require significant input from the Forest Department.

The national strategy should promote a coordinated approach to plant conservation across the whole of Belize, and across the whole flora, with a view to redressing historical sampling bias, and completing the national plant inventory. In addition, a more proactive approach to plant conservation and sustainable use of botanical resources is needed, i.e. recognising the conservation value of an important species (or area, or habitat) and putting measures in place to ensure continued survival in the wild before it becomes threatened. This requires more (and better) communication between the Belize Forest Department, protected area co-managers, logging companies, and conservationists.

A national strategy should not be viewed as a standalone project, completed in a set number of years, but rather should be continuous, evolving over time in response to new data, with annual reviews of progress towards specific short and medium-term goals. To have any chance of success, it is essential that the strategy is developed in collaboration with (and fully supported by) the Forest Department and the Environmental Research Institute. Implementation of the strategy would ideally be led by a Belizean institution, and protected area co-managers should be regarded as key stakeholders, since they are the 'boots-on-the ground' and will ultimately be responsible for carrying out the recommended actions.

[13] The three categories for defining an IPA are presence of threatened species, species richness, and threatened habitats. See http://www.plantlifeipa.org/home

Fostering long-term collaborations with universities and other research institutions (e.g. botanic gardens) should also be an integral part of the national strategy, so that there is a better knowledge exchange at the interface of research and practical conservation. For example, the Royal Botanic Garden Edinburgh (RBGE) have conducted research in various parts of Belize over the course of 16 years, which has included an annual field course, run as part of the MSc Biodiversity and Taxonomy of Plants. The field course has trained 26 Belizeans (including students and protected area rangers) in plant identification and best-practice herbarium specimen collecting (Goodwin *et al.,* 2019). These collections, as well as those amassed through the lowland savanna project (RBGE was a partner institution, see Chapter 2, and Goodwin *et al.,* 2013), have made a valuable contribution (c. 2,500 specimens in total) to documenting the flora of Belize.

Collaborations should aim to build national capacity in meaningful and long-lasting ways. Employing local people to help with data collection in the field is a good start, and short training courses in plant identification (of which there have been many in Belize) have their uses, but long-term mentorship (by experienced botanists and plant ecologists) of promising Belizean scientists would be far better. Unfortunately, there are still very few Belizean botanists. The marine environment, and charismatic terrestrial animal species appear to be a more appealing career path for Belizean graduates, and so there needs to be a greater effort to promote and inspire the study of plants. This could be achieved through collaborations with botanic gardens. Marie Selby Botanic Gardens (USA) plan to host at least two Belizean students in 2019 as part of their epiphyte inventory. This project has already provided extensive field collecting experience and plant identification training to several members of staff at Caves Branch Botanical Gardens in Belize, and staff from the USA have visited Belize to provide training in specimen mounting at the national herbarium.

Many of the actions that are likely to be put forward in the national strategy would take place within protected areas. For example, the majority of hotspots identified by this research fall within protected areas (see Chapter 5, Figure 5.2). Planning and implementing further data collection and/or additional measures to protect those hotspots would be the responsibility of protected area managers. As discussed in Chapter 1, management activities vary greatly across the country. Ultimately, retaining the integrity of the national protected area system relies on the political and social will to support conservation-related activities; from legislation and policy, through to management plans and on-the-ground actions. Many Belizeans are rightfully proud of the rich natural heritage of their country, and the Government of Belize frequently cites an admirable track record of success and innovation in conservation practice. Unfortunately, the financial benefits on offer from large-scale agriculture, oil production, or logging[14] have, in the past, proved to be worth more than the health and connectivity of Belize's ecosystems. With the highest population growth rate in Central America[15], achieving a balance between development and conservation is challenging. It is vital that protected area managers are armed with, at the very least, baseline biodiversity data to enable evidence-based decision-making regarding land use.

[14] See references in Chapter 1.
[15] In 2017, Belize had the highest population growth rate (annual percentage) in Central America. Population growth rate (annual percentage) was at its highest in 1998 (3.8%) but had dropped to 2.55% by 2004. Following a slight increase between 2004 – 2006 (2.6%), the annual percentage rate has steadily declined. Data obtained from www.worldbank.org, 2018.

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APPENDIX I

List of protected areas in Belize. Numbers correspond to those shown in Chapter 1, Figure 1.4.

Number	Name	Management category
1	Actun Tunichil Muknal	Natural Monument
2	Aguacaliente (Lu Ha)	Wildlife Sanctuary
3	Aguacate Lagoon	Private Reserve
4	Aguas Turbias	National Park
5	Alan Graham	Candidate Private Reserve
6	Altun Ha	Archaeological Reserve
7	Bacalar Chico	National Park
8	Balam Na	Candidate Private Reserve
9	Barton Creek	Archaeological Reserve
10	Belize Zoo Trust	Deed of Gift 1175/88
11	Belize Foundation for Research & Environmental Education	Candidate Private Reserve
12	Big Falls Estate	Candidate Private Reserve
13	Billy Barquedeer	National Park
14	Bird Caye	Bird Sanctuary
15	Bladen	Nature Reserve
16	Block 127	Private Reserve
17	Boden Creek Ecological Preserve	Candidate Private Reserve
19	Cahal Pech	Archaeological Reserve
20	Caracol	Archaeological Reserve
21	Caves Branch	Archaeological Reserve
22	Cerro Maya	Archaeological Reserve
23	Chiquibul	National Park
24	Chiquibul	Forest Reserve
25	Cockscomb Basin	Wildlife Sanctuary
26	Columbia River	Forest Reserve
27	Community Baboon Sanctuary	Private Reserve
28	Crooked Tree	Wildlife Sanctuary
29	Deep River	Forest Reserve
30	Dolphin Park	Public Reserve
31	Doubloon Bank	Bird Sanctuary
32	El Pilar	Archaeological Reserve
33	Finley	Candidate Private Reserve

Number	Name	Management category
34	Fireburn	Candidate Private Reserve
35	Five Blues Lake	National Park
36	Fresh Water Creek	Forest Reserve
37	Gales Point	Wildlife Sanctuary
38	Gallon Jug	Candidate Private Reserve
39	Golden Stream Corridor Preserve	Private Reserve
40	Gra Lagoon	National Park
41	Grants Works	Forest Reserve
42	Green Hills	Candidate Private Reserve
43	Guanacaste	National Park
44	Hidden Valley	Candidate Private Reserve
45	Honey Camp	National Park
46	Hopkins Wetlands	Nature Reserve
47	HWATCHY	Candidate Private Reserve
48	Jaguar Creek	Candidate Private Reserve
49	John Spang	Candidate Private Reserve
50	Johns	Candidate Private Reserve
51	Krooman	Public Reserve
52	Labouring Creek Jaguar Corridor	Wildlife Sanctuary
53	Laguna Seca LLC	Candidate Private Reserve
54	Lamanai	Archaeological Reserve
55	Lou Morski	Candidate Private Reserve
56	Lubaantun	Archaeological Reserve
57	Machaca	Forest Reserve
58	Mama Noots	Candidate Private Reserve
59	Man of War Caye	Bird Sanctuary
60	Manatee	Forest Reserve
61	Mango Creek	Forest Reserve
62	Maya Mountain	Forest Reserve
63	Mayflower Bocawina	National Park
64	Melinda	National Park
65	Monkey Bay	National Park
66	Monkey Bay Wildlife Sanctuary	Private Reserve
67	Monkey Caye	Bird Sanctuary
68	Mountain Pine Ridge	Forest Reserve

Number	Name	Management category
69	National Lands	Candidate Private Reserve
70	Nimli Punit	Archaeological Reserve
71	Nohoch Cheen	Archaeological Reserve
72	Nojkaaxmeen Eligio Panti	National Park
73	Payne's Creek	National Park
74	Peccary Hills	National Park
75	Rio Blanco	National Park
76	Rio Bravo Conservation and Management Area	Private Reserve
77	Runaway Creek	Private Reserve
78	San Pedro Company	Candidate Private Reserve
79	Santa Rita	Archaeological Reserve
80	Sarstoon-Temash	National Park
81	Seine Bight	Public Reserve
82	Serpon Sugar Mill	Archaeological Reserve
83	Shipstern Nature Reserve	Private Reserve
84	Shu	Candidate Private Reserve
85	Sibun	Forest Reserve
86	Sittee River	Forest Reserve
87	Spanish Creek	Wildlife Sanctuary
88	St. Herman's Blue Hole	National Park
89	St. Martin's	Candidate Private Reserve
90	Swasey-Bladen	Forest Reserve
91	Tapir Mountain	Nature Reserve
92	Thousand Foot Falls	Natural Monument
93	Unknown	Candidate Private Reserve
94	Vaca	Forest Reserve
95	Victoria Peak	Natural Monument
96	Xunantunich	Archaeological Reserve
97	Yalbac Ranch	Candidate Private Reserve
98	Yarborough Cemetery	Archaeological Reserve

APPENDIX II

Checklist of the vascular plants of Belize

This list presents 3,941 accepted names (including species and infra specific taxa). Methodology for generating the list of names is presented in Chapter 2. Star indicated in [ ]. BK = Black, GD = Gold, BU = Blue, GN = Green. Methodology for assigning taxa to Stars is detailed in Chapter 3.

ACANTHACEAE
***Aphelandra aurantiaca* (Scheidw.) Lindl.** [GN]
***Aphelandra scabra* (Vahl) Sm.** [GN]
***Asystasia gangetica* (L.) T. Anderson** [GN]
***Avicennia germinans* (L.) L.** [GN]
***Bravaisia berlandieriana* (Nees) T.F.Daniel** [GD]
***Bravaisia grandiflora* Donn. Sm.** [GD]
***Carlowrightia myriantha* (Standl.) Standl.** [GD]
***Dicliptera acuminata* (Ruiz & Pav.) Juss.** [GD]
***Dicliptera sexangularis* (L.) Juss.** [GN]
***Dicliptera sumichrastii* Lindau** [GD]
***Elytraria imbricata* (Vahl) Pers.** [GN]
***Hemigraphis alternata* (Burm. f.) T. Anderson** [GN]
***Hygrophila costata* Nees** [GN]
***Justicia albobracteata* Leonard** [BK]
***Justicia aurea* Schltdl.** [GN]
***Justicia bartlettii* (Leonard) D.N. Gibson** [GD]
***Justicia breviflora* (Nees) Rusby** [BU]
***Justicia campechiana* Standl.** [GD]
***Justicia candelariae* (Oerst.) Leonard** [BU]
***Justicia candicans* (Nees) L.D. Benson** [GD]
***Justicia comata* (L.) Lam.** [GN]
***Justicia ensiflora* (Standl.) D.N. Gibson** [GD]
***Justicia fimbriata* (Nees) V.A.W. Graham** [GD]
***Justicia pectoralis* Jacq.** [GN]
***Justicia spicigera* Schltdl.** [BU]
***Lepidagathis alopecuroidea* (Vahl) R. Br. ex Griseb.** [GN]
***Louteridium chartaceum* Leonard** [BK]
***Louteridium donnell-smithii* S. Watson** [GD]
***Mendoncia lindavii* Rusby** [GN]
***Mendoncia retusa* Turrill** [BU]
***Odontonema albiflorum* Leonard** [GD]
***Odontonema callistachyum* (Schltdl. & Cham.) Kuntze** [GN]
***Odontonema glabrum* Brandegee** [GD]
***Odontonema hondurense* (Lindau) D.N. Gibson** [GD]
***Odontonema tubaeforme* (Bertol.) Kuntze** [GN]
***Pseuderanthemum carruthersii* (Seem.) Guillaumin** [GN]
***Pseuderanthemum verapazense* Donn. Sm.** [GD]
***Ruellia blechum* L.** [GN]
***Ruellia geminiflora* Kunth** [GN]
***Ruellia harveyana* Stapf** [GD]
***Ruellia hookeriana* (Nees) Hemsl.** [BU]
***Ruellia matagalpae* Lindau** [GD]
***Ruellia nudiflora* (Engelm. & A. Gray) Urb.** [GN]
***Ruellia paniculata* L.** [GN]
***Ruellia pereducta* Standl. ex Lundell** [GD]
***Ruellia pygmaea* Donn. Sm.** [BK]
***Ruellia stemonacanthoides* (Oerst.) Hemsl.** [GD]
***Thunbergia alata* Bojer ex Sims** [GN]
***Thunbergia erecta* (Benth.) T. Anderson** [GN]
***Thunbergia fragrans* Roxb.** [GN]
***Thunbergia grandiflora* Roxb.** [GN]

ACHARIACEAE

Chiangiodendron mexicanum **T. Wendt** [GD]
Lindackeria laurina **C. Presl** [BU]
ACTINIDIACEAE
Saurauia yasicae **Loes.** [GN]

AGAVACEAE
Agave angustifolia **Haw.** [GN]
Agave sisalana **Perrine** [GN]
Furcraea guatemalensis **Trel.** [GD]
Yucca lacandonica **Gómez Pompa & Valdez** [GD]

AIZOACEAE
Sesuvium maritimum **(Walter) Britton, Sterns & Pogg** [GD]
Sesuvium portulacastrum **(L.) L.** [GN]

ALISMATACEAE
Echinodorus nymphaeifolius **(Griseb.) Buchenau** [GD]
Echinodorus paniculatus **Micheli** [GN]
Sagittaria lancifolia **L.** [GN]
Sagittaria lancifolia **L. subsp.** ***lancifolia*** [GN]
Sagittaria lancifolia **L. subsp.** ***media*** **(Micheli) Bogin** [BU]

ALSTROEMERIACEAE
Bomarea edulis **(Tussac) Herb.** [GN]

ALTINGIACEAE
Liquidambar styraciflua **L.** [BU]

AMARANTHACEAE
Alternanthera brasiliana **(L.) Kuntze** [GN]
Alternanthera caracasana **Kunth** [GN]
Alternanthera ficoidea **(L.) P. Beauv.** [GN]
Alternanthera flavescens **Kunth** [GN]
Alternanthera paronychioides **A. St.-Hil.** [GN]
Alternanthera sessilis **(L.) R. Br. ex DC.** [GN]
Amaranthus dubius **ex Martius, CFP von; Thell.** [GN]
Amaranthus polygonoides **L.** [GN]
Amaranthus viridis **L.** [GN]
Blutaparon vermiculare **(L.) Mears** [GN]
Chamissoa altissima **(Jacq.) Kunth** [GN]
Chamissoa altissima **(Jacq.) Kunth var.** ***altissima*** [GN]
Cyathula achyranthoides **(Kunth) Moq.** [GN]
Gomphrena globosa **L.** [GN]
Gomphrena serrata **L.** [GN]
Hebanthe grandiflora **(Hook.) Borsch & Pedersen** [GN]
Iresine arbuscula **Uline & W.L. Bray** [GD]
Iresine diffusa **Willd.** [GN]
Iresine nigra **Uline & W.L. Bray** [BU]
Pleuropetalum sprucei **(Hook.f.) Standl.** [GN]
Salicornia bigelovii **Torr.** [BU]

AMARYLLIDACEAE
Crinum erubescens **Aiton** [GN]
Crinum zeylanicum **(L.) L.** [GN]
Hymenocallis caribaea **(L.) Herb.** [BU]
Hymenocallis littoralis **(Jacq.) Salisb.** [GN]
Zephyranthes lindleyana **Herb.** [GD]

ANACARDIACEAE
Anacardium occidentale **L.** [GN]
Astronium fraxinifolium **Schott ex Spreng.** [GN]
Astronium graveolens **Jacq.** [GN]
Comocladia guatemalensis **Donn. Sm.** [GD]
Comocladia mayana **Atha, J.D. Mitch. & Pell** [BK]
Mangifera indica **L.** [GN]

***Metopium brownei* (Jacq.) Urb.** [BU]
***Mosquitoxylum jamaicense* Krug & Urb.** [BU]
***Spondias dulcis* Parkinson** [GN]
***Spondias mombin* L.** [GN]
***Spondias purpurea* L.** [GN]
***Spondias radlkoferi* Donn. Sm.** [GN]
***Tapirira guianensis* Aubl.** [GN]

ANEMIACEAE
***Anemia adiantifolia* (L.) Sw.** [GN]
***Anemia bartlettii* Mickel** [BK]
***Anemia mexicana* Klotzsch var. *makrinii* (Maxon) Mickel** [GD]
***Anemia oblongifolia* (Cav.) Sw.** [GN]
***Anemia pastinacaria* Moritz ex Prantl** [GN]
***Anemia phyllitidis* (L.) Sw.** [GN]
***Anemia speciosa* C. Presl** [GD]

ANNONACEAE
***Anaxagorea guatemalensis* Standl.** [GD]
***Annona cherimola* Mill.** [GN]
***Annona glabra* L.** [GN]
***Annona liebmanniana* Baill.** [GD]
***Annona muricata* L.** [GN]
***Annona primigenia* Standl. & Steyerm.** [BU]
***Annona purpurea* Moc. & Sessé ex Dunal** [GN]
***Annona reticulata* L.** [GN]
***Annona scleroderma* Saff.** [GD]
***Cymbopetalum mayanum* Lundell** [GD]
***Cymbopetalum penduliflorum* (Dunal) Baill.** [BU]
***Desmopsis erythrocarpa* Lundell** [BK]
***Desmopsis schippii* Standl.** [BU]
***Guatteria amplifolia* Triana & Planch.** [BU]
***Malmea depressa* (Baill.) R.E. Fr.** [GD]
Malmea depressa* (Baill.) R.E. Fr. subsp. *depressa [GD]
***Mosannona depressa* (Baill.) Chatrou** [GD]
Mosannona depressa* (Baill.) Chatrou subsp. *depressa [BU]
***Oxandra maya* Miranda** [BK]
***Rollinia mucosa* (Jacq.) Baill.** [GN]
***Sapranthus campechianus* (Kunth) Standl.** [GD]
***Stenanona stenopetala* (Donn. Sm.) G.E. Schatz** [BK]
***Unonopsis pittieri* Saff.** [BU]
***Xylopia frutescens* Aubl.** [GN]

APIACEAE
***Anethum graveolens* L.** [GN]
***Centella asiatica* (L.) Urb.** [GN]
***Centella erecta* (L. f.) Fernald** [GN]
***Eryngium foetidum* L.** [GN]
***Hydrocotyle umbellata* L.** [GN]
***Spananthe paniculata* Jacq.** [GN]

APOCYNACEAE
***Allamanda cathartica* L.** [GN]
***Asclepias curassavica* L.** [GN]
***Aspidosperma desmanthum* Benth. ex Müll.Arg.** [GN]
***Aspidosperma megalocarpon* Müll.Arg.** [GN]
***Aspidosperma spruceanum* Benth. ex Müll.Arg.** [GN]
***Blepharodon mucronatum* (Schltdl.) Decne.** [GN]
***Cameraria latifolia* L.** [BU]
***Catharanthus roseus* (L.) G. Don** [GN]
***Couma macrocarpa* Barb. Rodr.** [GN]
***Cryptostegia grandiflora* R. Br.** [GN]
***Cryptostegia madagascariensis* Bojer ex Decne.** [GN]
***Echites tuxtlensis* Standl.** [BU]
***Echites umbellatus* Jacq.** [GD]

***Echites yucatanensis* Standl.** [BU]
***Fischeria scandens* DC.** [BU]
***Forsteronia acouci* (Aubl.) A. DC.** [GN]
***Forsteronia myriantha* Donn. Sm.** [GN]
***Funastrum bilobum* (Hook. & Arn.) J.F. Macbr.** [GN]
***Funastrum clausum* (Jacq.) Schltr.** [GN]
***Gonolobus cteniophorus* (S.F. Blake) Woodson** [GD]
***Gonolobus dasystephanus* (S.F. Blake) Woodson** [BK]
***Gonolobus fraternus* Schltdl.** [BU]
***Gonolobus leianthus* Donn. Sm.** [BU]
***Gonolobus salvinii* Hemsl.** [GD]
***Gonolobus stenanthus* (Standl.) Woodson** [GD]
***Lacmellea standleyi* (Woodson) Monach.** [GD]
***Laubertia peninsularis* Woodson** [BK]
***Malouetia guatemalensis* (Müll.Arg.) Standl.** [GN]
***Mandevilla hirsuta* (Rich.) K. Schum.** [GN]
***Mandevilla subsagittata* (Ruiz & Pav.) Woodson** [GN]
***Marsdenia laxiflora* Donn. Sm.** [BU]
***Marsdenia macrophylla* (Humb. & Bonpl. ex Schult.) E.Fourn.** [GN]
***Marsdenia mayana* Lundell** [GD]
***Marsdenia propinqua* Hemsl.** [BU]
***Matelea belizensis* (Lundell & Standl.) Woodson** [BK]
***Matelea campechiana* (Standl.) Woodson** [GD]
***Matelea fulvida* (F. Ballard) W.D. Stevens** [GD]
***Matelea gentlei* (Lundell & Standl.) Woodson** [GD]
***Matelea lanceolata* (Decne.) Woodson** [GD]
***Matelea magnifolia* (Pittier) Woodson** [GD]
***Matelea micrantha* L.O. Williams** [GD]
***Matelea pusilliflora* L.O. Williams** [GD]
***Mesechites trifidus* (Jacq.) Müll.Arg.** [GN]
***Metalepis peraffinis* (Woodson) Morillo** [BU]
***Metastelma schlechtendalii* Decne.** [BU]
***Metastelma stenomeres* (Standl. & Steyerm.) W.D. Stevens** [GD]
***Metastelma thalamosiphon* W.D. Stevens** [GD]
***Mortoniella pittieri* Woodson** [GD]
***Nerium oleander* L.** [GN]
***Odontadenia macrantha* (Willd. ex Roem. & Schult.) Markgr.** [GN]
***Odontadenia puncticulosa* (Rich.) Pulle** [GN]
***Pentalinon andrieuxii* (Müll.Arg.) B.F. Hansen & Wunderlin** [BU]
***Plumeria obtusa* L.** [GN]
***Plumeria rubra* L.** [GN]
***Prestonia longifolia* (Sessé & Moc.) J.F. Morales** [BU]
***Prestonia mexicana* A. DC.** [GN]
***Prestonia portobellensis* (Beurl.) Woodson** [GN]
***Rauvolfia ligustrina* Willd. ex Roem. & Schult.** [GN]
***Rauvolfia tetraphylla* L.** [GN]
***Rhabdadenia biflora* (Jacq.) Müll.Arg.** [GN]
***Seutera angustifolia* (Pers.) Fishbein & W.D. Stevens** [GD]
***Stemmadenia donnell-smithii* (Rose) Woodson** [GN]
***Tabernaemontana alba* Mill.** [GN]
***Tabernaemontana amygdalifolia* Jacq.** [GN]
***Tabernaemontana arborea* Rose** [BU]
***Tassadia obovata* Decne.** [GN]
***Thevetia ahouai* (L.) A. DC.** [BU]
***Thevetia gaumeri* Hemsl.** [GD]
***Thevetia peruviana* (Pers.) K. Schum.** [GN]

APODANTHACEAE
***Apodanthes caseariae* Poit.** [GN]

AQUIFOLIACEAE
***Ilex belizensis* Lundell** [GD]
***Ilex guianensis* (Aubl.) Kuntze** [GN]
***Ilex tectonica* W.J. Hahn** [GD]

ARACEAE
***Alocasia macrorrhizos* (L.) G. Don** [GN]
***Anthurium bakeri* Hook.f.** [GN]
***Anthurium berriozabalense* Matuda** [GD]
***Anthurium flexile* Schott** [BU]
Anthurium flexile* Schott subsp. *flexile [BU]
***Anthurium gracile* (Rudge) Schott** [GN]
***Anthurium huixtlense* Matuda** [BU]
***Anthurium interruptum* Sodiro** [GN]
***Anthurium lucens* Standl.** [BU]
***Anthurium microspadix* Schott** [GN]
***Anthurium obtusum* (Engl.) Grayum** [GN]
***Anthurium pentaphyllum* (Aubl.) G. Don var. *bombacifolium* (Schott) Madison** [BU]
***Anthurium scandens* (Aubl.) Engl.** [GN]
Anthurium scandens* (Aubl.) Engl. subsp. *scandens [GN]
***Anthurium schlechtendalii* Kunth** [GN]
Anthurium schlechtendalii* Kunth subsp. *schlechtendalii [BU]
***Anthurium trinervium* Kunth** [GN]
***Anthurium verapazense* Engl.** [GD]
***Dieffenbachia oerstedii* Schott** [GN]
***Dieffenbachia seguine* (Jacq.) Schott** [GN]
***Lemna aequinoctialis* Welw.** [GN]
***Lemna valdiviana* Phil.** [GN]
***Monstera acacoyaguensis* Matuda** [GD]
***Monstera acuminata* K. Koch** [BU]
***Monstera dissecta* (Schott) Croat & Grayum** [GN]
***Monstera dubia* (Kunth) Engl. & K. Krause** [GN]
***Monstera punctulata* Schott ex Engl.** [GD]
***Monstera siltepecana* Matuda** [BU]
***Monstera tuberculata* Lundell** [BU]
Monstera tuberculata* Lundell var. *tuberculata [GD]
***Montrichardia arborescens* (L.) Schott** [GN]
***Philodendron advena* Schott** [BU]
***Philodendron aurantiifolium* Schott** [GN]
Philodendron aurantiifolium* Schott subsp. *aurantiifolium [GN]
***Philodendron dwyeri* Croat** [BK]
***Philodendron fragrantissimum* (Hook.) D. Don** [GN]
***Philodendron hederaceum* (Jacq.) Schott** [GN]
***Philodendron inaequilaterum* Liebm.** [GN]
***Philodendron jacquinii* Schott** [GN]
***Philodendron jodavisianum* G.S. Bunting** [GN]
***Philodendron radiatum* Schott** [GN]
Philodendron radiatum* Schott var. *radiatum [GN]
***Philodendron sagittifolium* Liebm.** [GN]
***Philodendron schottii* K. Koch** [BU]
***Philodendron schottii* K. Koch subsp. *talamancae* (Engl.) Grayum** [BU]
***Philodendron smithii* Engl.** [GN]
***Philodendron tripartitum* (Jacq.) Schott** [GN]
***Pistia stratiotes* L.** [GN]
***Rhodospatha wendlandii* Schott** [GN]
***Spathiphyllum blandum* Schott** [BU]
***Spathiphyllum cochlearispathum* (Liebm.) Engl.** [BU]
***Spathiphyllum phryniifolium* Schott** [GN]
***Syngonium angustatum* Schott** [GN]
***Syngonium angustifolium* Schott** [GD]
***Syngonium macrophyllum* Engl.** [GN]
***Syngonium neglectum* Schott** [BU]
***Syngonium podophyllum* Schott** [GN]
Syngonium podophyllum* Schott var. *podophyllum [GN]
***Syngonium standleyanum* G.S. Bunting** [GD]
***Syngonium triphyllum* Birdsey ex Croat** [GN]
***Urospatha grandis* Schott** [GD]
***Wolffia columbiana* H. Karst.** [GN]
***Xanthosoma mexicanum* Liebm.** [BU]
***Xanthosoma robustum* Schott** [BU]

***Xanthosoma sagittifolium* (L.) Schott** [GN]
***Xanthosoma undipes* (K. Koch & C. D. Bouché) K. Koch** [GN]
ARALIACEAE
***Dendropanax arboreus* (L.) Decne. & Planch.** [GN]
***Oreopanax capitatus* (Jacq.) Decne. & Planch.** [GN]
***Oreopanax geminatus* Marchal** [GD]
***Oreopanax sanderianus* Hemsl.** [GD]
***Schefflera actinophylla* (Endl.) Harms** [GN]
***Schefflera morototoni* (Aubl.) Maguire, Steyerm. & Frodin** [GN]

ARAUCARIACEAE
***Araucaria heterophylla* (Salisb.) Franco** [GN]

ARECACEAE
***Acoelorraphe wrightii* (Griseb. & H. Wendl.) H. Wendl. ex Becc.** [BU]
***Acrocomia aculeata* (Jacq.) Lodd. ex Mart.** [GN]
***Asterogyne martiana* (H. Wendl.) H. Wendl. ex Hemsl.** [BU]
***Astrocaryum mexicanum* Liebm. ex Mart.** [BU]
***Attalea cohune* Mart.** [GN]
***Bactris major* Jacq.** [GN]
***Bactris mexicana* Mart.** [BU]
***Bactris mexicana* Mart. var. *trichophylla* (Burret) A.J. Hend.** [GD]
***Calyptrogyne ghiesbreghtiana* (Linden & H. Wendl.) H. Wendl.** [GD]
***Calyptrogyne ghiesbreghtiana* (Linden & H. Wendl.) H. Wendl. subsp. *spicigera* (K. Koch) A.J. Hend.** [GD]
***Chamaedorea adscendens* (Dammer) Burret** [GD]
***Chamaedorea arenbergiana* H. Wendl.** [GD]
***Chamaedorea costaricana* Oerst.** [BU]
***Chamaedorea elegans* Mart.** [BU]
***Chamaedorea ernesti-augusti* H. Wendl.** [BU]
***Chamaedorea geonomiformis* H. Wendl.** [GD]
***Chamaedorea graminifolia* H. Wendl.** [GD]
***Chamaedorea neurochlamys* Burret** [GD]
***Chamaedorea oblongata* Mart.** [BU]
***Chamaedorea pinnatifrons* (Jacq.) Oerst.** [GN]
***Chamaedorea seifrizii* Burret** [GD]
***Chamaedorea tepejilote* Liebm.** [GN]
***Chamaedorea woodsoniana* L.H. Bailey** [GN]
***Cocos nucifera* L.** [GN]
***Colpothrinax cookii* Read** [GD]
***Cryosophila stauracantha* (Heynh.) R. Evans** [GD]
***Desmoncus chinantlensis* Liebm. ex Mart.** [BU]
***Desmoncus orthacanthos* Mart.** [GN]
***Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf.** [GN]
***Euterpe precatoria* Mart.** [GN]
***Euterpe precatoria* (Mart.) var. *longevaginata* (Mart.) A.J. Hend.** [GN]
***Gaussia maya* (O.F. Cook) Quero & Read** [BK]
***Geonoma deversa* (Poit.) Kunth** [GN]
***Geonoma deversa* subsp. *belizensis* A.J. Hend.** [GN]
***Geonoma interrupta* (Ruiz & Pav.) Mart.** [GN]
***Geonoma interrupta* subsp. *magnifica* (Linden & H. Wendl. ex H. Wendl.) A.J. Hend.** [GN]
Geonoma interrupta* (Ruiz & Pav.) Mart. var. *interrupta [BU]
***Reinhardtia gracilis* (H. Wendl.) Drude ex Dammer var. *gracilior* (Burret) H.E.Moore** [GD]
Reinhardtia gracilis* (H. Wendl.) Drude ex Dammer var. *gracilis [BU]
***Reinhardtia latisecta* (H. Wendl.) Burret** [GD]
***Sabal mauritiiformis* (H. Karst.) Griseb. & H. Wendl.** [GN]
***Sabal mexicana* Mart.** [BU]
***Sabal yapa* C. Wright ex Becc.** [GD]
***Schippia concolor* Burret** [BK]
***Synechanthus fibrosus* (H. Wendl.) H. Wendl.** [BU]
***Thrinax parviflora* Sw.** [BU]
***Thrinax radiata* Lodd. ex Schult. & Schult. f.** [GN]

ARISTOLOCHIACEAE
***Aristolochia arborea* Linden** [GN]
***Aristolochia grandiflora* Sw.** [GN]

Aristolochia leuconeura **Linden** [GD]
Aristolochia maxima **Jacq.** [GN]
Aristolochia odoratissima **L.** [GN]
Aristolochia ovalifolia **Duch.** [GD]
Aristolochia pentandra **Jacq.** [GD]
Aristolochia pilosa **Kunth** [GN]
Aristolochia tonduzii **O.C. Schmidt** [BU]
Aristolochia trilobata **L.** [GN]

ASPARAGACEAE
Beaucarnea pliabilis **(Baker) Rose** [GD]
Dracaena americana **Donn. Sm.** [BU]
Dracaena reflexa **Lam.** [GN]
Sansevieria hyacinthoides **(L.) Druce** [GN]
Sansevieria trifasciata **Prain** [GN]

ASPLENIACEAE
Asplenium abscissum **Willd.** [GN]
Asplenium auriculatum **Sw.** [GN]
Asplenium auritum **Sw.** [GN]
Asplenium cirrhatum **Rich. ex Willd.** [GN]
Asplenium cristatum **Lam.** [GN]
Asplenium delitescens **(Maxon) L.D. Gómez** [GN]
Asplenium dentatum **L.** [GN]
Asplenium formosum **Willd.** [GN]
Asplenium heterochroum **Kunze** [BU]
Asplenium juglandifolium **Lam.** [GN]
Asplenium laetum **Sw.** [GN]
Asplenium lamprocaulon **Fée** [GD]
Asplenium macilentum **Kunze ex Klotzsch** [GN]
Asplenium monodon **Liebm.** [BU]
Asplenium pteropus **Kaulf.** [GN]
Asplenium pumilum **Sw.** [GN]
Asplenium riparium **Liebm.** [GN]
Asplenium rutaceum **(Willd.) Mett.** [GN]
Asplenium serra **Langsd. & Fisch.** [GN]
Asplenium serratum **L.** [GN]
Asplenium uniseriale **Raddi** [GN]

ASTERACEAE
Acmella filipes **(Greenm.) R.K. Jansen** [GD]
Acmella lundellii **R.K. Jansen** [BK]
Acmella oppositifolia **(Lam.) R.K. Jansen** [GN]
Acmella oppositifolia **(Lam.) R.K. Jansen var.** ***oppositifolia*** [GN]
Acmella pilosa **R.K. Jansen** [GD]
Acourtia hondurana **B.L. Turner** [BK]
Acourtia nudicaulis **(A. Gray) B.L. Turner** [GN]
Ageratum conyzoides **L.** [GN]
Ageratum corymbosum **Zuccagni ex Persoon** [BU]
Ageratum ellipticum **B.L.Rob.** [BK]
Ageratum houstonianum **Mill.** [GN]
Ageratum littorale **A. Gray** [GD]
Ageratum maritimum **Kunth** [GD]
Ageratum peckii **B.L.Rob.** [BK]
Aldama dentata **La Llave & Lex.** [BU]
Ambrosia hispida **Pursh** [GN]
Artemisia ludoviciana **subsp.** ***mexicana*** **(Willd. ex Spreng.) D.D. Keck** [BU]
Baccharis salicifolia **(Ruiz & Pav.) Pers.** [GN]
Baccharis trinervis **Pers.** [GN]
Baltimora recta **L.** [GN]
Bidens pilosa **L.** [GN]
Bidens reptans **(L.) G. Don** [GN]
Borrichia arborescens **(L.) DC.** [BU]
Brickellia kellermanii **Greenm.** [GD]
Calea fluviatilis **S.F. Blake** [BK]

Calea jamaicensis **(L.) L.** [BU]
Calea longipedicellata **B.L.Rob. & Greenm.** [GD]
Calea ternifolia **Kunth** [BU]
Calea ternifolia **Kunth var.** ***ternifolia*** [BU]
Calea urticifolia **(Mill.) DC.** [GN]
Calea urticifolia **(Mill.) DC. var.** ***urticifolia*** [GD]
Calendula officinalis **L.** [GN]
Chaptalia albicans **(Sw.) Vent. ex Steud.** [BU]
Chaptalia nutans **(L.) Pol.** [GN]
Chromolaena glaberrima **(DC.) R.M. King & H.Rob.** [BU]
Chromolaena lundellii **R.M. King & H.Rob.** [GD]
Chromolaena odorata **(L.) R.M. King & H.Rob.** [GN]
Cirsium mexicanum **DC.** [GN]
Clibadium arboreum **Donn. Sm.** [BU]
Clibadium eggersii **Hieron.** [GN]
Condylidium iresinoides **(Kunth) R.M. King & H.Rob.** [GN]
Conyza bonariensis **(L.) Cronquist** [GN]
Conyza canadensis **(L.) Cronquist** [GN]
Conyza canadensis **(L.) Cronquist var.** ***canadensis*** [GN]
Conyza canadensis **(L.) Cronquist var.** ***pusilla*** **(Nutt.) Cronquist** [GN]
Conyza laevigata **(Rich.) Pruski** [GN]
Cosmos caudatus **Kunth** [GN]
Critonia bartlettii **(B.L.Rob.) R.M. King & H.Rob.** [GD]
Critonia billbergiana **(Beurl.) R.M. King & H.Rob.** [BU]
Critonia campechensis **(B.L.Rob.) R.M. King & H.Rob.** [GD]
Critonia daleoides **DC.** [BU]
Critonia lanicaulis **(B.L.Rob.) R.M. King & H.Rob.** [GD]
Critonia morifolia **(Mill.) R.M. King & H.Rob.** [GN]
Critonia sexangularis **(Klatt) R.M. King & H.Rob.** [BU]
Cyanthillium cinereum **(L.) H.Rob.** [GN]
Dahlia pinnata **Cav.** [GN]
Delilia biflora **(L.) Kuntze** [GN]
Eclipta prostrata **(L.) L.** [GN]
Egletes viscosa **(L.) Lees** [GN]
Elephantopus mollis **Kunth** [GN]
Eleutheranthera ruderalis **(Sw.) Sch. Bip.** [GN]
Emilia fosbergii **Nicolson** [GN]
Emilia sonchifolia **(L.) DC. ex DC.** [GN]
Emilia sonchifolia **var.** ***sonchifolia*** [GN]
Erechtites hieraciifolius **(L.) Raf. ex DC.** [GN]
Eremosis leiocarpa **DC.(Gleason)** [BU]
Flaveria linearis **Lag.** [GD]
Flaveria trinervia **(Spreng.) C. Mohr** [GN]
Fleischmannia blakei **(B.L.Rob.) R.M. King & H.Rob.** [BK]
Fleischmannia pratensis **(Klatt) R.M. King & H.Rob.** [GN]
Goldmanella sarmentosa **(Greenm.) Greenm.** [GD]
Harleya oxylepis **(Benth.) S.F. Blake** [BK]
Hebeclinium macrophyllum **(L.) DC.** [GN]
Helenium quadridentatum **Labill.** [GD]
Helianthus annuus **L.** [GN]
Hieracium gronovii **L.** [GN]
Koanophyllon albicaule **(Sch. Bip. ex Klatt) R.M. King & H.Rob.** [BU]
Koanophyllon galeottii **(B.L.Rob.) R.M. King & H.Rob.** [GD]
Koanophyllon pittieri **(Klatt) R.M. King & H.Rob.** [GN]
Koanophyllon solidaginoides **(Kunth) R.M. King & H.Rob.** [GN]
Koanophyllon sorensenii **R.M. King & H.Rob.** [BK]
Lagascea mollis **Cav.** [GN]
Lasianthaea fruticosa **(L.) K.M. Becker** [GN]
Lasianthaea fruticosa **(L.) K.M. Becker var.** ***fruticosa*** [GN]
Launaea intybacea **(Jacq.) Beauverd** [GN]
Lepidaploa canescens **(Kunth) H.Rob.** [GN]
Lepidaploa salzmannii **(DC.) H.Rob.** [GN]
Lepidaploa tortuosa **(L.) H.Rob.** [GN]
Lepidaploa uniflora **(Mill.) H.Rob.** [GD]
Lundellianthus belizeanus **(B.L. Turner) Strother** [BK]

Lundellianthus guatemalensis **(Donn. Sm.) Strother** [GD]
Melampodium costaricense **Stuessy** [GD]
Melampodium divaricatum **(Rich. ex Pers.) DC.** [GN]
Melampodium gracile **Less.** [BU]
Melanthera nivea **(L.) Small** [GN]
Mikania aromatica **Oerst.** [GD]
Mikania congesta **DC.** [GN]
Mikania cordifolia **(L. f.) Willd.** [GN]
Mikania guaco **Humb. & Bonpl.** [GN]
Mikania houstoniana **(L.) B.L.Rob.** [GN]
Mikania leiostachya **Benth.** [GN]
Mikania micrantha **Kunth** [GN]
Mikania pyramidata **Donn. Sm.** [GD]
Mikania vitifolia **DC.** [GN]
Milleria quinqueflora **L.** [GN]
Montanoa atriplicifolia **(Pers.) Sch. Bip.** [BU]
Montanoa speciosa **DC.** [GD]
Neomirandea araliifolia **(Less.) R.M. King & H.Rob.** [BU]
Neurolaena lobata **(L.) R. Br. ex Cass.** [GN]
Neurolaena schippii **B.L.Rob.** [BK]
Onoseris onoseroides **(Kunth) B.L.Rob.** [GN]
Orthopappus angustifolius **(Sw.) Gleason** [GN]
Otopappus curviflorus **(R. Br.) Hemsl.** [BU]
Otopappus guatemalensis **(Urb.) R.L. Hartm. & Stuessy** [GD]
Otopappus scaber **S.F. Blake** [GD]
Otopappus verbesinoides **Benth.** [BU]
Oyedaea lundellii **H.Rob.** [BK]
Parthenium hysterophorus **L.** [GN]
Pectis bonplandiana **Kunth** [GN]
Pectis prostrata **Cav.** [GN]
Perymenium ghiesbreghtii **B.L.Rob. & Greenm.** [BU]
Perymenium gymnolomoides **(Less.) DC.** [GD]
Piptocarpha poeppigiana **(DC.) Baker** [GN]
Pityopsis graminifolia **var.** ***tenuifolia*** **(Torr.) Semple & F.D. Bowers** [GD]
Pluchea baccharis **(Mill.) Pruski** [BU]
Pluchea carolinensis **(Jacq.) G. Don** [GN]
Pluchea odorata **(L.) Cass.** [GN]
Pluchea yucatanensis **G.L. Nesom** [GD]
Podachaenium eminens **(Lag.) Sch. Bip.** [GN]
Porophyllum punctatum **(Mill.) S.F. Blake** [GN]
Porophyllum ruderale **(Jacq.) Cass.** [GN]
Pseudelephantopus spicatus **(B. Juss. ex Aubl.) C.F. Baker** [GN]
Pseudognaphalium attenuatum **(DC.) Anderb.** [BU]
Pseudognaphalium roseum **(Kunth) Anderb.** [GD]
Pseudogynoxys chenopodioides **(Kunth) Cabrera** [GN]
Salmea scandens **(L.) DC.** [GN]
Schistocarpha eupatorioides **(Frenzel) Kuntze** [GN]
Sinclairia deamii **(B.L.Rob. & Bartlett) Rydb.** [GD]
Sinclairia discolor **Hook. & Arn.** [BU]
Sinclairia polyantha **(Klatt) Rydb.** [BU]
Smallanthus maculatus **(Cav.) H.Rob.** [GN]
Smallanthus uvedalia **(L.) Mack.** [BU]
Sonchus oleraceus **(L.) L.** [GN]
Sphagneticola trilobata **(L.) Pruski** [GN]
Spiracantha cornifolia **Kunth** [GN]
Struchium sparganophorum **(L.) Kuntze** [GN]
Symphyotrichum bullatum **(Klatt) G.L. Nesom** [GD]
Symphyotrichum subulatum **(Michx.) G.L. Nesom** [GN]
Synedrella nodiflora **(L.) Gaertn.** [GN]
Tagetes erecta **L.** [GN]
Telanthophora bartlettii **H.Rob. & Brettell** [BK]
Telanthophora cobanensis **(J.M. Coult.) H.Rob. & Brettell** [BU]
Tithonia diversifolia **(Hemsl.) A. Gray** [GN]
Tithonia hondurensis **La Duke** [GD]
Tithonia rotundifolia **(Mill.) S.F. Blake** [GN]

***Tridax procumbens* L.** [GN]
***Verbesina gigantea* Jacq.** [BU]
***Verbesina lanata* B.L.Rob. & Greenm.** [BU]
***Verbesina oerstediana* Benth.** [BU]
***Verbesina turbacensis* Kunth** [GN]
***Vernonanthura patens* (Kunth) H.Rob.** [GN]
***Viguiera cordata* (Hook. & Arn.) D'Arcy** [GN]
***Viguiera dentata* (Cav.) Spreng.** [BU]
***Wedelia acapulcensis* Kunth** [BU]
***Zexmenia serrata* La Llave & Lex.** [GD]
***Zinnia elegans* Jacq.** [GN]
***Zyzyura mayana* (Pruski) H. Rob. & Pruski** [BK]

BALANOPHORACEAE
Helosis cayanensis* (Sw.) Spreng. var. *cayanensis [GN]
***Helosis cayanensis* (Sw.) Spreng. var. *mexicana* (Liebm.) B.F. Hansen** [GN]
***Helosis cayenensis* (Sw.) Spreng.** [GN]

BALSAMINACEAE
***Impatiens balsamina* L.** [GN]
***Impatiens walleriana* Hook.f.** [GN]

BASELLACEAE
***Anredera vesicaria* (Lam.) C.F. Gaertn.** [GN]
***Basella alba* L.** [GN]

BATACEAE
***Batis maritima* L.** [GN]

BEGONIACEAE
***Begonia fischeri* Schrank** [GN]
***Begonia glabra* Aubl.** [GN]
***Begonia heracleifolia* Schltdl. & Cham.** [GN]
***Begonia nelumbonifolia* Schltdl. & Cham.** [BU]
***Begonia sericoneura* Liebm.** [GN]

BIGNONIACEAE
***Adenocalymma inundatum* DC.** [GN]
***Amphilophium crucigerum* (L.) L.G. Lohmann** [GN]
***Amphilophium paniculatum* (L.) Kunth** [GN]
Amphilophium paniculatum* (L.) Kunth var. *paniculatum [GN]
***Amphitecna breedlovei* A.H. Gentry** [GD]
***Amphitecna latifolia* (Mill.) A.H. Gentry** [GN]
***Anemopaegma chrysanthum* Dugand** [BU]
***Anemopaegma chrysoleucum* (Kunth) Sandwith** [GN]
***Arrabidaea verrucosa* (Standl.) A.H. Gentry** [GN]
***Bignonia diversifolia* Kunth** [GN]
***Bignonia hyacinthina* (Standl.) L.G. Lohmann** [GN]
***Bignonia neoheterophylla* L.G. Lohmann** [BU]
***Bignonia potosina* (K. Schum. & Loes.) L.G. Lohmann** [BU]
***Callichlamys latifolia* (Rich.) K. Schum.** [GN]
***Crescentia cujete* L.** [GN]
***Dolichandra uncata* (Andrews) L.G. Lohmann** [GN]
***Dolichandra unguis-cati* (L.) A.H. Gentry** [GN]
***Fridericia dichotoma* (Jacq.) Lohmann** [GN]
***Fridericia floribunda* (Kunth) L.G. Lohmann** [BU]
***Fridericia patellifera* (Schltdl.) L.G. Lohmann** [GN]
***Fridericia podopogon* (DC.) A.H. Gentry** [GD]
***Fridericia pubescens* (L.) L.G. Lohmann** [GN]
***Fridericia schumanniana* (Loes.) L.G. Lohmann** [GN]
***Godmania aesculifolia* (Kunth) Standl.** [GN]
***Handroanthus chrysanthus* (Jacq.) S.O. Grose** [GN]
***Handroanthus guayacan* (Seem.) S.O. Grose** [GN]
***Lundia puberula* Pittier** [GN]
***Mansoa hymenaea* (DC.) A.H. Gentry** [GN]

Martinella obovata **(Kunth) Bureau & K. Schum.** [GN]
Pachyptera kerere **(Aubl.) Sandwith** [GN]
Parmentiera aculeata **(Kunth) Seem.** [GN]
Podranea ricasoliana **(Tanfani) Sprague** [GN]
Spathodea campanulata **P. Beauv.** [GN]
Stizophyllum riparium **(Kunth) Sandwith** [GN]
Tabebuia capitata **(Bureau & K. Schum.) Sandwith** [GN]
Tabebuia rosea **(Bertol.) A. DC.** [GN]
Tanaecium caudiculatum **(Standl.) Lohmann** [BK]
Tanaecium tetragonolobum **(Jacq.) Lohmann** [GN]
Tecoma stans **(L.) Kunth** [GN]
Tynanthus guatemalensis **Donn. Sm.** [BU]
Xylophragma seemannianum **(Kuntze) Sandwith** [GN]

BIXACEAE
Bixa orellana **L.** [GN]

BLECHNACEAE
Blechnum appendiculatum **Willd.** [GN]
Blechnum ensiforme **(Liebm.) C. Chr.** [GN]
Blechnum fragile **(Liebm.) C.V. Morton & Lellinger** [GN]
Blechnum glandulosum **Kaulf. ex Link** [GN]
Blechnum gracile **Kaulf.** [GN]
Blechnum meridense **Klotzsch** [BU]
Blechnum occidentale **L.** [GN]
Blechnum serrulatum **Rich.** [GN]
Salpichlaena volubilis **(Kaulf.) J.Sm.** [GN]

BORAGINACEAE
Bourreria mollis **Standl.** [BU]
Cordia alliodora **(Ruiz & Pav.) Oken** [GN]
Cordia bicolor **A. DC.** [GN]
Cordia collococca **L.** [GN]
Cordia diversifolia **Pav. ex DC.** [GN]
Cordia dodecandra **A. DC.** [BU]
Cordia gerascanthus **L.** [GN]
Cordia panamensis **L. Riley** [GN]
Cordia sebestena **L.** [GN]
Cordia stellifera **I.M. Johnst.** [GD]
Ehretia tinifolia **L.** [GN]
Heliotropium angiospermum **Murray** [GN]
Heliotropium curassavicum **L.** [GN]
Heliotropium filiforme **Lehm.** [GN]
Heliotropium fruticosum **L.** [GN]
Heliotropium indicum **L.** [GN]
Heliotropium procumbens **Mill.** [GN]
Heliotropium transalpinum **Vell.** [GN]
Nama jamaicensis **L.** [GN]
Rochefortia spinosa **(Jacq.) Urb.** [BU]
Tournefortia acutiflora **M. Martens & Galeotti** [BU]
Tournefortia angustiflora **Ruiz & Pav.** [GN]
Tournefortia bicolor **Sw.** [GN]
Tournefortia glabra **L.** [GN]
Tournefortia gnaphalodes **(L.) Roem. & Schult.** [BU]
Tournefortia hirsutissima **L.** [GN]
Tournefortia maculata **Jacq.** [GN]
Tournefortia umbellata **Kunth** [BU]
Tournefortia volubilis **L.** [GN]
Varronia bullata **L.** [GN]
Varronia curassavica **Jacq.** [GN]
Varronia globosa **Jacq.** [GN]
Varronia spinescens **(L.) Borhidi** [GN]

BRASSICACEAE
Brassica juncea **(L.) Czern.** [GN]

***Cakile lanceolata* (Willd.) O.E. Schulz** [BU]
***Cakile lanceolata* (Willd.) O.E. Schulz subsp. *fusiformis* (Greene) Rodman** [BU]
Cakile lanceolata* (Willd.) O.E. Schulz subsp. *lanceolata [BU]
***Lepidium costaricense* Thell.** [BU]
***Lepidium virginicum* L.** [GN]

BROMELIACEAE
***Aechmea bracteata* (Sw.) Griseb.** [BU]
***Aechmea bromeliifolia* (Rudge) Baker** [GN]
***Aechmea lueddemanniana* (K. Koch) Brongn. ex Mez** [BU]
***Aechmea magdalenae* (André) André ex Baker** [GN]
***Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker** [GN]
***Ananas comosus* (L.) Merr.** [GN]
***Androlepis skinneri* Brongn. ex Houllet** [BU]
***Billbergia viridiflora* H.L. Wendl.** [GD]
***Bromelia pinguin* L.** [GN]
***Catopsis berteroniana* (Schult. & Schult. f.) Mez** [GN]
***Catopsis morreniana* Mez** [BU]
***Catopsis sessiliflora* (Ruiz & Pav.) Mez** [GN]
***Guzmania lingulata* (L.) Mez** [GN]
Guzmania lingulata* (L.) Mez var. *lingulata [GN]
***Guzmania nicaraguensis* Mez & C.F. Baker** [BU]
***Guzmania scherzeriana* Mez** [BU]
***Pitcairnia heterophylla* (Lindl.) Beer** [GN]
***Pitcairnia imbricata* (Brongn.) Regel** [BU]
***Pitcairnia punicea* Scheidw.** [GD]
***Pitcairnia recurvata* (Scheidw.) K. Koch** [GD]
***Pitcairnia wendlandii* Baker** [GD]
***Tillandsia anceps* Lodd.** [GN]
***Tillandsia balbisiana* Schult. f.** [GN]
***Tillandsia brachycaulos* Schltdl.** [GN]
***Tillandsia bulbosa* Hook.** [GN]
***Tillandsia butzii* Mez** [BU]
***Tillandsia dasyliriifolia* Baker** [BU]
***Tillandsia excelsa* Griseb.** [BU]
***Tillandsia fasciculata* Sw.** [GN]
***Tillandsia festucoides* Brongn. ex Mez** [GN]
***Tillandsia filifolia* Schltdl. & Cham.** [BU]
***Tillandsia juncea* (Ruiz & Pav.) Poir.** [GN]
***Tillandsia leiboldiana* Schltdl.** [GN]
***Tillandsia monadelpha* (E. Morren) Baker** [GN]
***Tillandsia multicaulis* Steud.** [BU]
***Tillandsia orogenes* Standl. & L.O. Williams** [GD]
***Tillandsia pruinosa* Sw.** [GN]
***Tillandsia punctulata* Schltdl. & Cham.** [GN]
***Tillandsia schiedeana* Steud.** [GN]
Tillandsia schiedeana* Steud. subsp. *schiedeana [GN]
***Tillandsia standleyi* L.B.Sm.** [GD]
***Tillandsia streptophylla* Scheidw. ex C. Morren** [BU]
***Tillandsia tricolor* Schltdl. & Cham.** [BU]
***Tillandsia usneoides* (L.) L.** [GN]
***Tillandsia utriculata* L.** [GN]
***Tillandsia variabilis* Schltdl.** [GN]
***Tillandsia viridiflora* (Beer) Baker** [GD]
***Vriesea gladioliflora* (H. Wendl.) Antoine** [GN]
***Vriesea heliconioides* (Kunth) Hook. ex Walp.** [GN]
***Vriesea werckleana* Mez** [BU]
***Werauhia viridiflora* (Regel) J.R. Grant** [BU]
***Werauhia werckleana* (Mez) J.R. Grant** [BU]

BRUNELLIACEAE
***Brunellia mexicana* Standl.** [BU]

BURMANNIACEAE
***Burmannia capitata* (Walter ex J.F. Gmel.) Mart.** [GN]

Burmannia flava **Mart.** [GN]
Dictyostega orobanchoides **(Hook.) Miers subsp. *orobanchoides*** [BU]
Gymnosiphon divaricatus **(Benth.) Benth. & Hook.f.** [GN]
Gymnosiphon panamensis **Jonker** [BU]

BURSERACEAE
Bursera simaruba **(L.) Sarg.** [GN]
Protium confusum **(Rose) Pittier** [BU]
Protium copal **(Schltdl. & Cham.) Engl.** [GN]
Protium glabrum **(Rose) Engl.** [BU]
Protium multiramiflorum **Lundell** [GD]
Tetragastris panamensis **(Engl.) Kuntze** [GN]

BUXACEAE
Buxus bartlettii **Standl.** [GD]

CABOMBACEAE
Brasenia schreberi **J.F. Gemel.** [GN]
Cabomba palaeformis **Fassett** [BU]

CACTACEAE
Epiphyllum crenatum **(Lindl.) G. Don** [BU]
Epiphyllum oxypetalum **(DC.) Haw.** [GN]
Epiphyllum phyllanthus **(L.) Haw.** [GN]
Hylocereus minutiflorus **Britton & Rose** [BK]
Opuntia cochenillifera **(L.) Mill.** [GN]
Pseudorhipsalis ramulosa **(Salm-Dyck) Barthlott** [GN]
Rhipsalis baccifera **(J.S. Muell.) Stearn** [GN]
Selenicereus donkelaarii **(Salm-Dyck) Britton & Rose** [GD]
Selenicereus macdonaldiae **(Hook.) Britton & Rose** [BK]
Selenicereus testudo **(Karw.) Buxb.** [BU]
Selenicereus tricae **D.R. Hunt** [BK]

CALOPHYLLACEAE
Calophyllum brasiliense **Cambess.** [GN]
Calophyllum brasiliense **Cambess. var. *rekoi* (Standl.) Standl.** [GN]

CAMPANULACEAE
Diastatea micrantha **(Kunth) McVaugh** [GN]
Hippobroma longiflora **(L.) G. Don** [GN]
Lobelia cardinalis **L.** [GN]
Lobelia sartorii **Vatke** [GD]
Lobelia tatea **(E. Wimm.) E. Wimm.** [GD]
Lobelia xalapensis **Kunth** [GN]

CANNABACEAE
Celtis iguanaea **(Jacq.) Sarg.** [GN]
Celtis schippii **Standl.** [GN]
Celtis trinervia **Lam.** [BU]
Trema integerrima **(Beurl.) Standl.** [GN]
Trema micrantha **(L.) Blume** [GN]
Trema micrantha **(L.) Blume var. *floridana* (Britton ex Small) Standl.** [GN]
Trema micrantha **(L.) Blume var. *micrantha*** [GN]

CANNACEAE
Canna indica **L.** [GN]
Canna tuerckheimii **Kraenzl.** [GN]

CAPPARACEAE
Capparidastrum discolor **(Donn. Sm.) Cornejo & Iltis** [BU]
Capparidastrum frondosum **(Jacq.) Cornejo & Iltis** [GN]
Capparidastrum quiriguense **(Standl.) Cornejo & Iltis** [GD]
Capparis cynophallophora **L.** [GN]
Crateva tapia **L.** [GN]
Cynophalla flexuosa **(L.) J. Presl** [BU]

***Forchhammeria trifoliata* Radlk.** [BU]
***Quadrella calciphila* (Standl. & Steyerm.) Iltis & Cornejo** [GD]
***Quadrella isthmensis* subsp. *mexicana* Cornejo & Iltis** [GN]

CARICACEAE
***Carica papaya* L.** [GN]
***Jacaratia dolichaula* (Donn. Sm.) Woodson** [BU]
***Jacaratia mexicana* A. DC.** [BU]

CARYOPHYLLACEAE
***Drymaria cordata* (L.) Willd. ex Roem. & Schult.** [GN]

CASUARINACEAE
***Casuarina cunninghamiana* Miq.** [GN]
***Casuarina equisetifolia* L.** [GN]
Casuarina equisetifolia* L. subsp. *equisetifolia [GN]

CELASTRACEAE
***Celastrus vulcanicola* Donn. Sm.** [BU]
***Cheiloclinium belizense* (Standl.) A.C.Sm.** [GN]
***Crossopetalum filipes* (Sprague) Lundell** [GD]
***Crossopetalum gaumeri* (Loes.) Lundell** [GD]
***Crossopetalum parviflorum* (Hemsl.) Lundell** [BU]
***Crossopetalum rhacoma* Crantz** [BU]
***Elachyptera floribunda* (Benth.) A.C.Sm.** [GN]
***Elaeodendron xylocarpum* (Vent.) DC.** [GN]
***Hippocratea volubilis* L.** [GN]
***Maytenus belizensis* Standl.** [BK]
***Maytenus schippii* Lundell** [BU]
***Salacia elliptica* (Mart.) G. Don** [GN]
***Salacia impressifolia* (Miers) A.C.Sm.** [GN]
***Schaefferia frutescens* Jacq.** [GN]
***Semialarium mexicanum* (Miers) Mennega** [BU]
***Tontelea hondurensis* A.C.Sm.** [BU]
***Wimmeria bartlettii* Lundell** [GD]
***Zinowiewia pallida* Lundell** [BK]

CHLORANTHACEAE
***Hedyosmum mexicanum* C. Cordem.** [GN]

CHRYSOBALANACEAE
***Chrysobalanus icaco* L.** [GN]
***Couepia polyandra* (Kunth) Rose** [BU]
***Hirtella americana* L.** [GN]
***Hirtella guatemalensis* Standl.** [BU]
***Hirtella racemosa* Lam.** [GN]
***Hirtella racemosa* Lam. var. *hexandra* (Willd. ex Roem. & Schult.) Prance** [GN]
***Hirtella triandra* Sw.** [GN]
***Licania arborea* Seem.** [GN]
***Licania hypoleuca* Benth.** [GN]
Licania hypoleuca* Benth. var. *hypoleuca [GN]
***Licania platypus* (Hemsl.) Fritsch** [GN]
***Licania sparsipilis* S.F. Blake** [BU]

CIBOTIACEAE
***Cibotium regale* Verschaff. & Lem.** [BU]

CISTACEAE
***Lechea torreyi* Legg. ex Britton** [GD]

CLEOMACEAE
***Andinocleome pilosa* (Benth.) Iltis & Cochrane** [BU]
***Cleoserrata serrata* (Jacq.) Iltis** [GN]
***Corynandra viscosa* (L.) Cochrane & Iltis** [GN]
***Mitostylis macrorhiza* (C. Wright) Iltis** [GD]

***Physostemon lanceolatum* subsp. *oaxacensis* (Iltis) Iltis** [GN]
Tarenaya spinosa* (Jacq.) Raf. subsp. *spinosa [BU]

CLETHRACEAE
***Clethra mexicana* DC.** [GN]
***Clethra occidentalis* (L.) Kuntze** [BU]

CLUSIACEAE
***Chrysochlamys guatemaltecana* Donn. Sm.** [GD]
***Clusia belizensis* Standl.** [GD]
***Clusia flava* Jacq.** [GN]
***Clusia flavida* (Benth.) Pipoly** [GN]
***Clusia guatemalensis* Hemsl.** [BU]
***Clusia lundellii* Standl.** [BU]
***Clusia massoniana* Lundell** [BU]
***Clusia minor* L.** [GN]
***Clusia quadrangula* Bartlett** [BU]
***Clusia rosea* Jacq.** [GN]
***Clusia salvinii* Donn. Sm.** [GN]
***Clusia stenophylla* Standl.** [BU]
***Garcinia intermedia* (Pittier) Hammel** [GN]
***Marila laxiflora* Rusby** [GN]
***Symphonia globulifera* L. f.** [GN]
Symphonia globulifera* L. f. subsp. *globulifera [GN]

COCHLOSPERMACEAE
***Cochlospermum vitifolium* (Willd.) Spreng.** [GN]

COMBRETACEAE
***Bucida buceras* L.** [GN]
***Combretum assimile* Eichler** [GN]
***Combretum cacoucia* Exell** [GN]
***Combretum fruticosum* (Loefl.) Stuntz** [GN]
***Combretum laxum* Jacq.** [GN]
***Combretum rovirosae* Exell** [GD]
***Conocarpus erectus* L.** [GN]
Conocarpus erectus* L. var. *erectus [GN]
***Laguncularia racemosa* (L.) C.F. Gaertn.** [GN]
***Terminalia amazonia* (J.F. Gmel.) Exell** [GN]
***Terminalia catappa* L.** [GN]
***Terminalia macrostachya* (Standl.) Stace** [BU]
***Terminalia molinetii* M. Gómez** [GD]
***Terminalia oblonga* (Ruiz & Pav.) Steud.** [GN]

COMMELINACEAE
***Callisia cordifolia* (Sw.) E.S. Anderson & Woodson** [GN]
***Callisia gentlei* Matuda** [GD]
***Callisia multiflora* (M. Martens & Galeotti) Standl.** [GD]
***Commelina diffusa* Burm. f.** [GN]
***Commelina erecta* L.** [GN]
***Commelina leiocarpa* Benth.** [GN]
***Commelina rufipes* Seub.** [GN]
***Commelina rufipes* Seub. var. *glabrata* (D.R. Hunt) Faden & D.R. Hunt** [GN]
***Dichorisandra hexandra* (Aubl.) Standl.** [GN]
***Gibasis geniculata* (Jacq.) Rohweder** [GN]
***Tradescantia poelliae* D.R. Hunt** [BU]
***Tradescantia schippii* D.R. Hunt** [BU]
***Tradescantia spathacea* Sw.** [GN]
***Tradescantia zanonia* (L.) Sw.** [GN]
***Tradescantia zebrina* Heynh.** [GN]
***Tradescantia zebrina* hort. ex Bosse var. *flocculosa* (G. Brückn.) D.R. Hunt** [GN]
Tradescantia zebrina* hort. ex Bosse var. *zebrina [GN]
***Tripogandra grandiflora* (Donn. Sm.) Woodson** [BU]
***Tripogandra serrulata* (Vahl) Handlos** [GN]

CONNARACEAE
***Cnestidium rufescens* Planch.** [GN]
***Connarus lambertii* (DC.) Sagot** [GN]
***Rourea glabra* Kunth** [GN]
Rourea glabra* Kunth var. *glabra [GN]
***Rourea schippii* Standl.** [BU]

CONVOLVULACEAE
***Aniseia martinicensis* (Jacq.) Choisy** [GN]
***Argyreia nervosa* (Burm. f.) Bojer** [GN]
***Convolvulus nodiflorus* Desr.** [GN]
***Cuscuta indecora* Choisy** [GN]
***Evolvulus alsinoides* (L.) L.** [GN]
***Evolvulus filipes* Mart.** [GN]
***Evolvulus nummularius* (L.) L.** [GN]
***Evolvulus sericeus* Sw.** [GN]
***Ipomoea alba* L.** [GN]
***Ipomoea anisomeres* B.L.Rob. & Bartlett** [GN]
***Ipomoea aristolochiifolia* G. Don** [GN]
***Ipomoea batatas* (L.) Lam.** [GN]
***Ipomoea carnea* Jacq.** [GN]
Ipomoea carnea* Jacq. subsp. *carnea [GN]
***Ipomoea carnea* Jacq. subsp. *fistulosa* (Mart. ex Choisy) D.F. Austin** [GN]
***Ipomoea clavata* (G. Don) Ooststr. ex J.F. Macbr.** [GN]
***Ipomoea crinicalyx* S.Moore** [GN]
***Ipomoea hederifolia* L.** [GN]
***Ipomoea heterodoxa* Standl. & Steyerm.** [GN]
***Ipomoea imperati* (Vahl) Griseb.** [GN]
***Ipomoea indica* (Burm.) Merr.** [GN]
***Ipomoea lindenii* Mart. & Galeotti** [GN]
***Ipomoea mauritiana* Jacq.** [GN]
***Ipomoea minutiflora* (M. Martens & Galeotti) House** [GN]
***Ipomoea nil* (L.) Roth** [GN]
***Ipomoea pes-caprae* (L.) R. Br.** [GN]
***Ipomoea philomega* (Vell.) House** [GN]
***Ipomoea quamoclit* L.** [GN]
***Ipomoea ramosissima* (Poir.) Choisy** [GN]
***Ipomoea sagittata* Poir.** [GN]
***Ipomoea sepacuitensis* Donn. Sm.** [GD]
***Ipomoea setifera* Poir.** [GN]
***Ipomoea setosa* Ker Gawl.** [GN]
***Ipomoea splendor-sylvae* House** [BU]
***Ipomoea squamosa* Choisy** [GN]
***Ipomoea tiliacea* (Willd.) Choisy** [GN]
***Ipomoea trifida* (Kunth) G. Don** [GN]
***Ipomoea triloba* L.** [GN]
***Ipomoea tuxtlensis* House** [BU]
***Ipomoea violacea* L.** [GN]
***Itzaea sericea* (Standl.) Standl. & Steyerm.** [GD]
***Jacquemontia ciliata* Sandwith** [GN]
***Jacquemontia havanensis* (Jacq.) Urb.** [GD]
***Jacquemontia pentanthos* (Jacq.) G. Don** [GN]
***Jacquemontia sphaerostigma* (Cav.) Rusby** [GN]
***Jacquemontia tamnifolia* (L.) Griseb.** [GN]
***Jacquemontia verticillata* (L.) Urb.** [GD]
***Maripa nicaraguensis* Hemsl.** [GN]
***Merremia aegyptia* (L.) Urb.** [GN]
***Merremia aturensis* (Kunth) Hallier f.** [GN]
***Merremia cissoides* (Lam.) Hallier f.** [GN]
***Merremia dissecta* (Jacq.) Hallier f.** [GN]
***Merremia quinquefolia* (L.) Hallier** [GN]
***Merremia tuberosa* (L.) Rendle** [GN]
***Merremia umbellata* (L.) Hallier** [GN]
***Odonellia hirtiflora* (M. Martens & Galeotti) K.R. Robertson** [GN]

***Turbina corymbosa* (L.) Raf.** [GN]

COSTACEAE
***Costus guanaiensis* Rusby var. *macrostrobilus* (K. Schum.) Maas** [GN]
***Costus pictus* D. Don** [BU]
***Costus pulverulentus* C. Presl** [GN]
***Costus spicatus* (Jacq.) Sw.** [GN]
***Costus villosissimus* Jacq.** [GN]
***Hellenia speciosa* (J. Koenig) Govaerts** [GN]

CRASSULACEAE
***Kalanchoe integra* (Medik.) Kuntze** [GN]
***Kalanchoe pinnata* (Lam.) Pers.** [GN]

CUCURBITACEAE
***Cayaponia longiloba* A.K. Monro** [BU]
***Cayaponia racemosa* (Mill.) Cogn.** [GN]
***Cucumis melo* L.** [GN]
***Cucurbita lundelliana* L.H. Bailey** [GD]
***Cucurbita moschata* (Lam.) Poir.** [GN]
***Echinopepon racemosus* (Steud.) C. Jeffrey** [GN]
***Echinopepon wrightii* (A. Gray) S. Watson** [GD]
***Gurania makoyana* (Lem.) Cogn.** [GN]
***Ibervillea millspaughii* (Cogn.) C. Jeffrey** [GD]
***Luffa cylindrica* (L.) M. Roem.** [GN]
***Melothria pendula* L.** [GN]
***Melothria trilobata* Cogn.** [GN]
***Momordica charantia* L.** [GN]
***Psiguria triphylla* (Miq.) C. Jeffrey** [GN]
***Psiguria warscewiczii* (Hook.f.) Wunderlin** [GN]
***Rytidostylis gracilis* Hook. & Arn.** [GN]
***Sechium edule* (Jacq.) Sw.** [GN]
***Sicydium tamnifolium* (Kunth) Cogn.** [GN]
***Sicydium tuerckheimii* Donn. Sm.** [BU]

CUPRESSACEAE
***Cupressus lusitanica* Mill.** [GN]
***Platycladus orientalis* (L.) Franco** [GN]

CYATHEACEAE
***Alsophila firma* (Baker) D.S. Conant** [GN]
***Cnemidaria decurrens* (Liebm.) R.M. Tryon** [GD]
***Cyathea costaricensis* (Mett. ex Kuhn) Domin** [BU]
***Cyathea divergens* Kunze** [GN]
***Cyathea divergens* Kunze var. *tuerckheimii* (Maxon) R.M. Tryon** [BU]
***Cyathea grayumii* A. Rojas** [BK]
***Cyathea microdonta* (Desv.) Domin** [GN]
***Cyathea multiflora* Sm.** [GN]
***Cyathea myosuroides* (Liebm.) Domin** [BU]
***Cyathea schiedeana* (C. Presl) Domin** [GN]
***Cyathea ursina* (Maxon) Lellinger** [GD]
***Sphaeropteris horrida* (Liebm.) R.M. Tryon** [BU]

CYCLANTHACEAE
***Asplundia labela* (R.E. Schult.) Harling** [BU]
***Asplundia utilis* (Oerst.) Harling** [GN]
***Carludovica palmata* Ruiz & Pav.** [GN]
***Cyclanthus bipartitus* Poit.** [GN]

CYMODOCEACEAE
***Halodule wrightii* Asch.** [GN]
***Syringodium filiforme* Kütz.** [GD]

CYPERACEAE

Abildgaardia ovata **(Burm. f.) Kral** [GN]
Becquerelia tuberculata **(Boeck.) H. Pfeiff.** [GN]
Bulbostylis barbata **(Rottb.) C.B.Clarke** [GN]
Bulbostylis capillaris **(L.) Kunth ex C.B.Clarke** [GN]
Bulbostylis hispidula **(Vahl) R.W. Haines** [GN]
Bulbostylis junciformis **(Kunth) C.B.Clarke** [GN]
Bulbostylis juncoides **(Vahl) Kük. ex Osten** [GN]
Bulbostylis paradoxa **(Spreng.) Lindm.** [GN]
Bulbostylis tenuifolia **(Rudge) J.F. Macbr.** [GN]
Calyptrocarya glomerulata **(Brongn.) Urb.** [GN]
Carex polystachya **Sw. ex Wahlenb.** [GN]
Carex polystachya **Sw. ex Wahlenb. var.** ***bartletti*** **(O'Neill) Standl. & Steyerm.** [GN]
Cladium jamaicense **Crantz** [GN]
Cyperus aggregatus **(Willd.) Endl.** [GN]
Cyperus articulatus **L.** [GN]
Cyperus articulatus **L. var.** ***articulatus*** [GN]
Cyperus compressus **L.** [GN]
Cyperus diffusus **Vahl** [GN]
Cyperus digitatus **Roxb.** [GN]
Cyperus elegans **L.** [GN]
Cyperus giganteus **Vahl** [GN]
Cyperus haspan **L.** [GN]
Cyperus hermaphroditus **(Jacq.) Standl.** [GN]
Cyperus humilis **Kunth** [GN]
Cyperus imbricatus **Retz.** [GN]
Cyperus involucratus **Rottb.** [GN]
Cyperus laxus **Lam.** [GN]
Cyperus lentiginosus **Millsp. & Chase** [BU]
Cyperus ligularis **L.** [GN]
Cyperus lundellii **O'Neill** [GD]
Cyperus luzulae **(L.) Rottb. ex Retz.** [GN]
Cyperus ochraceus **Vahl** [GN]
Cyperus odoratus **L.** [GN]
Cyperus panamensis **(C.B.Clarke) Britton ex Standl.** [BU]
Cyperus planifolius **Rich.** [BU]
Cyperus pseudovegetus **Steud. var.** ***megalanthus*** **Kük.** [GD]
Cyperus rotundus **L.** [GN]
Cyperus simplex **Kunth** [GN]
Cyperus surinamensis **Rottb.** [GN]
Cyperus tenuis **Sw.** [GN]
Cyperus thyrsiflorus **Jungh.** [GN]
Eleocharis acutangula **(Roxb.) Schult.** [GN]
Eleocharis cellulosa **Torr.** [GN]
Eleocharis elegans **(Kunth) Roem. & Schult.** [GN]
Eleocharis elongata **Chapm.** [GN]
Eleocharis filiculmis **Kunth** [GN]
Eleocharis flavescens **(Poir.) Urb.** [GN]
Eleocharis geniculata **(L.) Roem. & Schult.** [GN]
Eleocharis interstincta **(Vahl) Roem. & Schult.** [GN]
Eleocharis maculosa **(Vahl) Roem. & Schult.** [GN]
Eleocharis minima **Kunth** [GN]
Eleocharis minima **Kunth var.** ***bicolor*** **(Chapm.) Svenson** [GN]
Eleocharis minutissima **Britton** [GD]
Eleocharis mitrata **Franch. & Sav. ex Makino** [GN]
Eleocharis montana **(Kunth) Roem. & Schult.** [GN]
Eleocharis mutata **(L.) Roem. & Schult.** [GN]
Eleocharis pachystyla **(C. Wright) C.B.Clarke** [GN]
Eleocharis retroflexa **(Poir.) Urb.** [GN]
Fimbristylis autumnalis **(L.) Roem. & Schult.** [GN]
Fimbristylis complanata **(Retz.) Link** [GN]
Fimbristylis cymosa **(Lam.) R. Br.** [GN]
Fimbristylis dichotoma **(L.) Vahl** [GN]
Fimbristylis ferruginea **(L.) Vahl** [GN]
Fimbristylis littoralis **Gaudich.** [GN]
Fimbristylis spadicea **(L.) Vahl** [GN]

***Fimbristylis vahlii* (Lam.) Link** [GN]
***Fuirena camptotricha* C. Wright** [BU]
***Fuirena simplex* Vahl** [GN]
***Fuirena umbellata* Rottb.** [GN]
***Hypolytrum longifolium* (Rich.) Nees subsp. *nicaraguense* (Liebm.) T. Koyama** [GN]
***Kyllinga brevifolia* Rottb.** [GN]
***Kyllinga odorata* Vahl** [GN]
***Kyllinga pumila* Michx.** [GN]
***Kyllinga tibialis* Ledeb.** [GN]
***Kyllinga vaginata* Lam.** [GN]
***Lagenocarpus guianensis* Nees** [GN]
***Pycreus polystachyos* (Rottb.) P. Beauv.** [GN]
***Pycreus unioloides* (R. Br.) Urb.** [GN]
***Remirea maritima* Aubl.** [GN]
***Rhynchospora aristata* Boeckeler** [GN]
***Rhynchospora barbata* (Vahl) Kunth** [GN]
***Rhynchospora berteroi* (Spreng.) C.B.Clarke** [GD]
***Rhynchospora brachychaeta* C. Wright** [GD]
***Rhynchospora brevirostris* Griseb.** [GN]
***Rhynchospora cephalotes* (L.) Vahl** [GN]
***Rhynchospora chapmanii* M.A. Curtis** [GD]
***Rhynchospora colorata* (L.) H. Pfeiff.** [GN]
***Rhynchospora contracta* (Nees) J. Raynal** [GN]
***Rhynchospora corymbosa* (L.) Britton** [GN]
Rhynchospora corymbosa* (L.) Britton var. *corymbosa [GN]
***Rhynchospora curvula* Griseb.** [GN]
***Rhynchospora divergens* Chapm. ex M.A. Curtis** [BU]
***Rhynchospora exaltata* Kunth** [GN]
***Rhynchospora eximia* (Nees) Boeck.** [GN]
***Rhynchospora fascicularis* (Michx.) Vahl** [GN]
***Rhynchospora filifolia* A. Gray** [GD]
***Rhynchospora filiformis* Vahl** [GN]
***Rhynchospora floridensis* (Britton) H. Pfeiff.** [GD]
***Rhynchospora globosa* (Kunth) Roem. & Schult.** [GN]
***Rhynchospora globularis* (Chapm.) Small** [GN]
***Rhynchospora globularis* (Chapm.) Small var. *pinetorum* (Britton & Small) Gale** [GN]
***Rhynchospora gracilenta* A. Gray** [GD]
***Rhynchospora harperi* Small** [GD]
***Rhynchospora hassleri* C.B.Clarke** [GN]
***Rhynchospora hirsuta* (Vahl) Vahl** [GN]
***Rhynchospora holoschoenoides* (Rich.) Herter** [GN]
***Rhynchospora marisculus* Lindl. ex Nees** [GN]
***Rhynchospora marliniana* Naczi, W. M. Knapp & W.W. Thomas** [GD]
***Rhynchospora mexicana* (Liebm.) Steud.** [GD]
***Rhynchospora microcarpa* Baldwin ex A. Gray** [GN]
***Rhynchospora nervosa* (Vahl) Boeck.** [GN]
***Rhynchospora nervosa* (Vahl) Boeck. subsp. *ciliata* (G.Mey.) T. Koyama** [GN]
Rhynchospora nervosa* (Vahl) Boeck. subsp. *nervosa [GN]
***Rhynchospora nitens* (Vahl) A. Gray** [GN]
***Rhynchospora nitens* (Vahl) A. Gray var. *hispaniolica* Kük.** [GN]
***Rhynchospora oligantha* A. Gray** [BU]
Rhynchospora oligantha* A. Gray var. *oligantha [BU]
***Rhynchospora pedersenii* Guagl.** [GN]
***Rhynchospora plumosa* Elliott** [BU]
***Rhynchospora polyphylla* Vahl(Vahl)** [GN]
***Rhynchospora pusilla* Chapm. ex M.A. Curtis** [BU]
***Rhynchospora radicans* (Schltdl. & Cham.) H. Pfeiff.** [BU]
***Rhynchospora radicans* (Schltdl. & Cham.) H. Pfeiff. subsp. *microcephala* (Bertero ex Spreng.) W.W. Thomas** [GN]
Rhynchospora radicans* (Schltdl. & Cham.) H. Pfeiff. subsp. *radicans [GN]
***Rhynchospora rariflora* (Michx.) Elliott** [GN]
***Rhynchospora recognita* (Gale) Kral** [GN]
***Rhynchospora rugosa* (Vahl) Gale** [GN]
***Rhynchospora tenerrima* Nees ex Spreng.** [GN]
***Rhynchospora tenuis* Willd. ex Link** [GN]
***Rhynchospora tracyi* Britton** [GD]

***Rhynchospora triflora* Vahl** [GN]
***Rhynchospora trispicata* (Nees) Schrad. ex Steud.** [GN]
***Rhynchospora velutina* (Kunth) Boeck.** [GN]
***Rhynchospora watsonii* (Britton) Davidse** [GN]
***Schoenoplectus americanus* (Pers.) Volkart ex Schinz & R. Keller** [GN]
***Schoenus nigricans* L.** [GN]
***Scleria bracteata* Cav.** [GN]
***Scleria ciliata* Michx.** [GN]
***Scleria distans* Poir.** [GN]
***Scleria eggersiana* Boeck.** [GN]
***Scleria georgiana* Core** [GD]
***Scleria hirtella* Sw.** [GN]
***Scleria interrupta* Rich.** [GN]
***Scleria lacustris* C. Wright** [GN]
***Scleria latifolia* Sw.** [GN]
***Scleria lithosperma* (L.) Sw.** [GN]
***Scleria macrophylla* J. Presl & C. Presl** [GN]
***Scleria melaleuca* Rchb. ex Schltdl. & Cham.** [GN]
***Scleria microcarpa* Nees ex Kunth** [GN]
***Scleria mitis* P.J. Bergius** [GN]
***Scleria reticularis* Michx.** [GN]
***Scleria secans* (L.) Urb.** [GN]
***Scleria tenella* Kunth** [GN]
***Scleria verticillata* Muhl. ex Willd.** [GN]
Torulinium macrocephalum* (Liebm.) C.B.Clarke var. *macrocephalum [BU]

CYRILLACEAE
***Cyrilla racemiflora* L.** [GN]
***Purdiaea belizensis* (A.C.Sm. & Standl.) J.L. Thomas** [GD]

DENNSTAEDTIACEAE
***Dennstaedtia bipinnata* (Cav.) Maxon** [GN]
***Dennstaedtia cicutaria* (Sw.) T.Moore** [GN]
***Dennstaedtia dissecta* (Sw.) T.Moore** [GN]
***Hypolepis repens* (L.) C. Presl** [GN]
***Pteridium aquilinum* (L.) Kuhn** [GN]
***Pteridium arachnoideum* (Kaulf.) Maxon** [GN]
***Pteridium caudatum* (L.) Maxon** [GN]

DICHAPETALACEAE
***Dichapetalum axillare* Woodson** [BU]
***Dichapetalum brenesii* Standl.** [GD]
***Dichapetalum donnell-smithii* Engl.** [BU]
***Dichapetalum donnell-smithii* Engl. var. *chiapasense* (Standl.) Prance** [BU]
Dichapetalum donnell-smithii* Engl. var. *donnell-smithii [BU]

DICKSONIACEAE
Lophosoria quadripinnata* (J.F. Gmel.) C. Chr. var. *quadripinnata [GN]

DILLENIACEAE
***Curatella americana* L.** [GN]
***Davilla kunthii* A. St.-Hil.** [GN]
***Davilla nitida* (Vahl) Kubitzki** [GN]
***Doliocarpus brevipedicellatus* Garcke** [GN]
***Doliocarpus dentatus* (Aubl.) Standl.** [GN]
Doliocarpus dentatus* (Aubl.) Standl. subsp. *dentatus [GN]
***Doliocarpus major* J.F. Gmel.** [GN]
***Doliocarpus multiflorus* Standl.** [GN]
***Pinzona coriacea* Mart. & Zucc.** [GN]
***Tetracera hydrophila* Triana & Planch.** [GN]
***Tetracera volubilis* L.** [GN]
***Tetracera volubilis* L. subsp. *mollis* (Standl.) Kubitzki** [BU]

DIOSCOREACEAE
***Dioscorea alata* L.** [GN]

***Dioscorea bartlettii* C.V. Morton** [GD]
***Dioscorea bulbifera* L.** [GN]
***Dioscorea composita* Hemsl.** [BU]
***Dioscorea convolvulacea* Schltdl. & Cham.** [GN]
***Dioscorea densiflora* Hemsl.** [BU]
***Dioscorea floribunda* M. Martens & Galeotti** [BU]
***Dioscorea gaumeri* R. Knuth** [BK]
***Dioscorea hondurensis* R. Knuth** [GN]
***Dioscorea matagalpensis* Uline** [BU]
***Dioscorea mexicana* Scheidw.** [BU]
***Dioscorea polygonoides* Humb. & Bonpl. ex Willd.** [GN]
***Dioscorea sandwithii* B.G. Schub.** [BK]
***Dioscorea spiculiflora* Hemsl.** [BU]

DROSERACEAE
***Drosera brevifolia* Pursh** [BU]
***Drosera capillaris* Poir.** [GN]

DRYOPTERIDACEAE
***Arachniodes denticulata* (Sw.) Ching** [GN]
***Bolbitis bernoullii* (Kuhn ex H. Christ) Ching** [BU]
***Bolbitis hastata* (E.Fourn.) Hennipman** [GD]
***Bolbitis hemiotis* (Maxon) Ching** [GD]
***Bolbitis pergamentacea* (Maxon) Ching** [GN]
***Bolbitis portoricensis* (Spreng.) Hennipman** [GN]
***Bolbitis serratifolia* (Mert. ex Kaulf.) Schott** [GN]
Ctenitis equestris* (Kunze) Ching var. *equestris [BU]
***Ctenitis excelsa* (Desv.) Proctor** [GN]
***Ctenitis interjecta* (C. Chr.) Ching** [GD]
***Ctenitis lanceolata* (Baker) A.R. Sm.** [BK]
***Ctenitis melanosticta* (Kunze) Copel.** [BU]
***Ctenitis nigrovenia* (H. Christ) Copel.** [BU]
***Ctenitis salvinii* (Baker) Stolze** [GD]
***Ctenitis sloanei* (Poepp. ex Spreng.) C.V. Morton** [GN]
***Didymochlaena truncatula* (Sw.) J.Sm.** [GN]
***Elaphoglossum apodum* (Kaulf.) Schott ex J. Sm.** [BU]
***Elaphoglossum correae* Mickel** [GD]
***Elaphoglossum decursivum* Mickel** [BU]
***Elaphoglossum erinaceum* (Fée) T.Moore** [GN]
***Elaphoglossum eximiiforme* Mickel** [GD]
***Elaphoglossum glaucum* T.Moore** [GD]
***Elaphoglossum guatemalense* (Klotzsch) T.Moore** [GD]
***Elaphoglossum herminieri* (Bory ex Fée) T.Moore** [BU]
***Elaphoglossum herrerae* A. Rojas** [BU]
***Elaphoglossum latifolium* (Sw.) J.Sm.** [GN]
***Elaphoglossum latum* (Mickel) Atehortúa ex Mickel** [GN]
***Elaphoglossum peltatum* (Sw.) Urb.** [GN]
***Elaphoglossum rigidum* (Aubl.) Urb.** [GN]
***Elaphoglossum rubescens* Christ** [GD]
***Elaphoglossum variabile* A. Rojas** [BU]
***Lastreopsis effusa* (Sw.) Tindale** [GN]
***Lastreopsis effusa* (Sw.) Tindale subsp. *divergens* (Willd. ex Schkuhr) Tindale** [GN]
***Lastreopsis exculta* (Mett.) Tindale** [GN]
***Megalastrum lunense* (H. Christ) A.R.Sm. & R.C. Moran** [BU]
***Olfersia cervina* (L.) Kunze** [GN]
***Peltapteris peltata* (Sw.) C.V. Morton** [GN]
***Polybotrya caudata* Kunze** [GN]
***Polybotrya osmundacea* Humb. & Bonpl. ex Willd.** [GN]
***Polybotrya polybotryoides* (Baker) H. Christ** [GN]
***Stigmatopteris sordida* (Maxon) C. Chr.** [GN]

EBENACEAE
***Diospyros bumelioides* Standl.** [GD]
***Diospyros nigra* (J.F. Gmel.) Perr.** [BU]
***Diospyros salicifolia* Humb. & Bonpl. ex Willd.** [BU]

***Diospyros tetrasperma* Sw.** [BU]
***Diospyros yatesiana* Standl.** [GD]

ELAEOCARPACEAE
***Sloanea laurifolia* (Benth.) Benth.** [GN]
***Sloanea longipes* Ducke** [GD]
***Sloanea meianthera* Donn. Sm.** [GN]
***Sloanea petenensis* Standl. & Steyerm.** [GD]
***Sloanea schippii* Standl.** [GD]
***Sloanea terniflora* (DC.) Standl.** [GN]
***Sloanea tuerckheimii* Donn. Sm.** [GN]

EQUISETACEAE
***Equisetum giganteum* L.** [GN]

ERICACEAE
***Agarista mexicana* (Hemsl.) Judd** [BU]
Agarista mexicana* (Hemsl.) Judd var. *mexicana [GD]
***Agarista mexicana* (Hemsl.) Judd var. *pinetorum* (Standl. & L.O. Williams) Judd** [GD]
***Bejaria aestuans* Mutis ex L.** [GN]
***Cavendishia laurifolia* (Klotzsch) Benth. & Hook.f.** [BU]
***Monotropa uniflora* L.** [GN]
***Orthaea brachysiphon* (Sleumer) Luteyn** [BK]
***Satyria meiantha* Donn. Sm.** [BU]
***Satyria warszewiczii* Klotzsch** [BU]
***Sphyrospermum cordifolium* Benth.** [GN]

ERIOCAULACEAE
***Eriocaulon benthamii* Kunth** [GD]
***Eriocaulon cinereum* R. Br.** [GN]
***Eriocaulon decangulare* L.** [BU]
***Eriocaulon fuliginosum* C. Wright ex Griseb.** [GD]
***Eriocaulon kinlochii* Moldenke** [GD]
***Eriocaulon schiedeanum* Körn.** [GD]
***Eriocaulon schippii* Standl. ex Moldenke** [GD]
***Eriocaulon williamsii* Moldenke** [GD]
***Paepalanthus belizensis* Moldenke** [BK]
***Paepalanthus gentlei* Moldenke** [BK]
***Paepalanthus lamarckii* Kunth** [GN]
***Syngonanthus bartlettii* Moldenke** [BK]
***Syngonanthus hondurensis* Moldenke** [BK]
***Syngonanthus lundellianus* Moldenke** [BK]
***Syngonanthus oneillii* Moldenke** [BK]
***Tonina fluviatilis* Aubl.** [GN]

ERYTHROXYLACEAE
***Erythroxylum areolatum* L.** [GN]
***Erythroxylum bequaertii* Standl.** [GD]
***Erythroxylum confusum* Britton** [GD]
***Erythroxylum guatemalense* Lundell** [BU]
***Erythroxylum macrophyllum* Cav.** [GN]
***Erythroxylum rotundifolium* Lunan** [GN]

EUPHORBIACEAE
***Acalypha alopecuroidea* Jacq.** [BU]
***Acalypha arvensis* Poepp.** [GN]
***Acalypha costaricensis* (Kuntze) Knobl. ex Pax & K.Hoffm.** [BU]
***Acalypha diversifolia* Jacq.** [GN]
***Acalypha gentlei* Atha** [GD]
***Acalypha gummifera* Lundell** [GD]
***Acalypha hispida* Burm. f.** [GN]
***Acalypha lancetillae* Standl.** [GD]
***Acalypha leptopoda* Müll.Arg.** [BU]
***Acalypha macrostachya* Jacq.** [GN]
***Acalypha mortoniana* Lundell** [GD]

***Acalypha schlechtendalia* Müll.Arg.** [GD]
***Acalypha setosa* A. Rich.** [GN]
***Acalypha skutchii* I.M. Johnst.** [GD]
***Acalypha villosa* Jacq.** [GN]
***Acalypha wilkesiana* Müll.Arg.** [GN]
***Adelia barbinervis* Schltdl. & Cham.** [BU]
***Alchornea latifolia* Sw.** [GN]
***Alchorneopsis floribunda* (Benth.) Müll.Arg.** [GN]
***Bernardia dodecandra* (Sessé ex Cavagnaro, David) McVaugh** [GD]
***Caperonia castaneifolia* (L.) A. St.-Hil.** [GN]
***Caperonia palustris* (L.) A. St.-Hil.** [GN]
***Chamaesyce hypericifolia* (L.) Millsp.** [GN]
***Chamaesyce mesembryanthemifolia* (Jacq.) Dugand** [BU]
***Cleidion castaneifolium* Müll.Arg.** [GN]
***Cnidoscolus aconitifolius* (Mill.) I.M. Johnst.** [GN]
***Cnidoscolus multilobus* (Pax) I.M. Johnst.** [GD]
***Cnidoscolus souzae* McVaugh** [GD]
***Cnidoscolus tubulosus* (Müll.Arg.) I.M. Johnst.** [GN]
***Cnidoscolus urens* (L.) Arthur** [GN]
***Codiaeum variegatum* (L.) A. Juss.** [GN]
***Croton arboreus* Millsp.** [BU]
***Croton argenteus* L.** [GN]
***Croton billbergianus* Müll.Arg.** [BU]
***Croton chichenensis* Lundell** [GD]
***Croton cortesianus* Kunth** [BU]
***Croton glabellus* L.** [BU]
***Croton glandulosepalus* Millsp.** [GD]
***Croton hirtus* L'Hér.** [GN]
***Croton lobatus* L.** [GN]
***Croton malvaviscifolius* Millsp.** [BK]
***Croton nitens* Sw.** [GD]
***Croton niveus* Jacq.** [GN]
***Croton punctatus* Jacq.** [BU]
***Croton reflexifolius* Kunth** [BU]
***Croton repens* Schltdl.** [BU]
***Croton schiedeanus* Schltdl.** [GN]
***Croton trinitatis* Millsp.** [GN]
***Croton xalapensis* Kunth** [BU]
***Dalechampia cissifolia* Poepp. subsp. *panamensis* (Pax & K.Hoffm.) G.L.** [BU]
***Dalechampia laevigata* Standl.** [GD]
***Dalechampia scandens* L.** [GN]
***Dalechampia schippii* Standl.** [BK]
***Dalechampia spathulata* (Scheidw.) Baill.** [GN]
***Dalechampia tiliifolia* Lam.** [GN]
***Ditaxis guatemalensis* (Müll.Arg.) Pax & K.Hoffm.** [GD]
***Euphorbia armourii* Millsp.** [GD]
***Euphorbia blodgettii* Engelm. ex Hitchc.** [BU]
***Euphorbia colletioides* Benth.** [GD]
***Euphorbia cozumelensis* Millsp.** [GD]
***Euphorbia cyathophora* Murray** [GN]
***Euphorbia graminea* Jacq.** [GN]
***Euphorbia heterophylla* L.** [GN]
***Euphorbia hirta* L.** [GN]
***Euphorbia hypericifolia* L.** [GN]
***Euphorbia hyssopifolia* L.** [GN]
***Euphorbia lancifolia* Schltdl.** [BU]
***Euphorbia lasiocarpa* Klotzsch** [GN]
***Euphorbia mendezii* Boiss.** [GD]
***Euphorbia mesembryanthemifolia* Jacq.** [GN]
***Euphorbia ocymoidea* L.** [BU]
***Euphorbia prostrata* Aiton** [GN]
***Euphorbia pulcherrima* Willd. ex Klotzsch** [GN]
***Euphorbia schlechtendalii* Boiss.** [BU]
***Euphorbia serpens* Kunth** [GN]
***Euphorbia thymifolia* L.** [GN]

***Euphorbia tirucalli* L.** [GN]
***Euphorbia tithymaloides* L.** [GN]
***Euphorbia trichotoma* Kunth** [GD]
***Euphorbia xbacensis* Millsp.** [BK]
***Gymnanthes belizensis* G.L.Webster** [BK]
***Gymnanthes lucida* Sw.** [BU]
***Hieronyma alchorneoides* Allemão** [GN]
Hieronyma alchorneoides* Allemão var. *alchorneoides [GN]
***Hieronyma oblonga* (Tul.) Müll.Arg.** [GN]
***Hippomane mancinella* L.** [GN]
***Hura crepitans* L.** [GN]
***Jatropha curcas* L.** [GN]
***Jatropha gaumeri* Greenm.** [BU]
Jatropha gossypifolia [GN]
***Jatropha integerrima* Jacq.** [GN]
***Mabea occidentalis* Benth.** [GN]
***Manihot aesculifolia* (Kunth) Pohl** [BU]
***Manihot esculenta* Crantz** [GN]
***Pedilanthus tithymaloides* (L.) Poit.** [GN]
Pedilanthus tithymaloides* (L.) Poit. subsp. *tithymaloides [GN]
***Pera arborea* Mutis** [GN]
***Pera barbellata* Standl.** [GD]
***Pleradenophora tuerckheimiana* (Pax & K. Hoffm.) A. L. Melo & Esser** [GD]
***Plukenetia penninervia* Müll.Arg.** [GN]
***Ricinus communis* L.** [GN]
***Sapium glandulosum* (L.) Morong** [GN]
***Sapium lateriflorum* Hemsl.** [GD]
***Sapium laurifolium* (A. Rich.) Griseb.** [GN]
***Sapium macrocarpum* Müll.Arg.** [GN]
***Sebastiania adenophora* Pax & K.Hoffm.** [GD]
***Sebastiania confusa* Lundell** [GD]
***Sebastiania tuerckheimiana* (Pax & K.Hoffm.) Lundell** [GD]
***Stillingia zelayensis* (Kunth) Müll.Arg.** [BU]
***Tragia glanduligera* Pax & K.Hoffm.** [GD]
***Tragia mexicana* Müll.Arg.** [GD]
***Tragia volubilis* L.** [GN]
***Tragia yucatanensis* Millsp.** [GD]

FABACEAE - CAESALPINIOIDEAE
***Bauhinia cookii* Rose** [BU]
***Bauhinia divaricata* L.** [BU]
***Bauhinia erythrocalyx* Wunderlin** [GD]
***Bauhinia glabra* Jacq.** [GN]
***Bauhinia guianensis* Aubl.** [GN]
***Bauhinia herrerae* (Britton & Rose) Standl. & Steyerm.** [BU]
***Bauhinia jenningsii* P. Wilson** [BU]
***Bauhinia microstachya* (Raddi) J.F. Macbr.** [GN]
***Bauhinia purpurea* L.** [GN]
***Bauhinia ungulata* L.** [GN]
***Bauhinia variegata* L.** [GN]
***Caesalpinia bonduc* (L.) Roxb.** [GN]
***Caesalpinia crista* L.** [GN]
***Caesalpinia gaumeri* Greenm.** [BU]
***Caesalpinia pulcherrima* (L.) Sw.** [GN]
***Caesalpinia vesicaria* L.** [BU]
***Caesalpinia violacea* (Mill.) Standl.** [GN]
***Caesalpinia yucatanensis* Greenm.** [BU]
***Cassia fistula* L.** [GN]
***Cassia grandis* L.** [GN]
***Cassia javanica* L.** [GN]
***Cassia moschata* Kunth** [GN]
***Chamaecrista desvauxii* (Collad.) Killip** [GN]
***Chamaecrista desvauxii* (Collad.) Killip var. *mollissima* (Benth.) H.S. Irwin & Barneby** [GN]
***Chamaecrista diphylla* (L.) Greene** [GN]
***Chamaecrista fagonioides* (Vogel) H.S. Irwin & Barneby** [GN]

Chamaecrista fagonioides **(Vogel) H.S. Irwin & Barneby var.** ***fagonioides*** [GN]
Chamaecrista flexuosa **(L.) Greene** [GN]
Chamaecrista flexuosa **(L.) Greene var.** ***flexuosa*** [GN]
Chamaecrista glandulosa **var.** ***flavicoma*** **(Kunth) H.S. Irwin & Barneby** [GN]
Chamaecrista hispidula **(Vahl) H.S. Irwin & Barneby** [GN]
Chamaecrista kunthiana **(Schltdl. & Cham.) H.S. Irwin & Barneby** [GN]
Chamaecrista nictitans **(L.) Moench** [GN]
Chamaecrista nictitans **(L.) Moench var.** ***disadena*** **(Steud.) H.S. Irwin & Barneby** [GN]
Chamaecrista nictitans **(L.) Moench var.** ***jaliscensis*** **(Greenm.) H.S. Irwin & Barneby** [GN]
Chamaecrista nictitans **(L.) Moench var.** ***pilosa*** **(Benth.) H.S. Irwin & Barneby** [GN]
Chamaecrista nictitans **(L.) Moench var.** ***ramosa*** **(Vogel) H.S. Irwin & Barneby** [GN]
Chamaecrista rotundifolia **(Pers.) Greene var.** ***grandiflora*** **(Benth.) H.S. Irwin & Barneby** [GN]
Chamaecrista zygophylloides **(Taub.) H.S. Irwin & Barneby var.** ***deamii*** **(Britton & Rose) H.S. Irwin & Barneby** [GN]
Cynometra hemitomophylla **(Donn. Sm.) Rose** [GD]
Delonix regia **(Bojer ex Hook.) Raf.** [GN]
Dialium guianense **(Aubl.) Sandwith** [GN]
Haematoxylum brasiletto **H. Karst.** [BU]
Haematoxylum campechianum **L.** [GN]
Hymenaea courbaril **L.** [GN]
Parkinsonia aculeata **L.** [GN]
Peltophorum pterocarpum **(DC.) Backer ex K. Heyne** [GN]
Schizolobium parahyba **(Vell.) S.F. Blake** [GN]
Senna alata **(L.) Roxb.** [GN]
Senna alexandrina **Mill.** [GN]
Senna atomaria **(L.) H.S. Irwin & Barneby** [GN]
Senna bicapsularis **(L.) Roxb.** [GN]
Senna cobanensis **(Britton & Rose) H.S. Irwin & Barneby** [GN]
Senna fruticosa **(Mill.) H.S. Irwin & Barneby** [GN]
Senna hayesiana **(Britton & Rose) H.S. Irwin & Barneby** [GN]
Senna hirsuta **(L.) H.S. Irwin & Barneby var.** ***hirta*** **H.S. Irwin & Barneby** [GN]
Senna mollissima **(Humb. & Bonpl. ex Willd.) H.S. var.** ***glabrata*** **(Benth.) H.S. Irwin** [BU]
Senna obtusifolia **(L.) H.S. Irwin & Barneby** [GN]
Senna occidentalis **(L.) Link** [GN]
Senna pallida **(Vahl) H.S. Irwin & Barneby** [GN]
Senna papillosa **(Britton & Rose) H.S. Irwin & B** [GN]
Senna pendula **(Humb. & Bonpl. ex Willd.) H.S. var.** ***advena*** **(Vogel) H.S. Irwin & B** [GN]
Senna pendula **(Willd.) H.S. Irwin & Barneby var.** ***hemirostrata*** **(Lass.) H.S. Irwin & Barneby** [GN]
Senna peralteana **(Kunth) H.S. Irwin & Barneby** [GN]
Senna racemosa **(Mill.) H.S. Irwin & Barneby** [GN]
Senna racemosa **(Mill.) H.S. Irwin & Barneby var.** ***racemosa*** [GN]
Senna reticulata **(Willd.) H.S. Irwin & Barneby** [GN]
Senna siamea **(Lam.) H.S. Irwin & Barneby** [GN]
Senna spectabilis **(DC.) H.S. Irwin & Barneby var.** ***spectabilis*** [GN]
Senna undulata **(Benth.) H.S. Irwin & Barneby** [GN]
Senna uniflora **(Mill.) H.S. Irwin & Barneby** [GN]
Tamarindus indica **L.** [GN]

FABACEAE - FABOIDEAE
Abrus precatorius **L.** [GN]
Abrus precatorius **L. subsp.** ***africanus*** **Verdc.** [GN]
Acosmium panamense **(Benth.) Yakovlev** [BU]
Aeschynomene americana **L.** [GN]
Aeschynomene deamii **B.L.Rob. & Bartlett** [BU]
Aeschynomene fascicularis **Schltdl. & Cham.** [BU]
Aeschynomene filosa **Mart. ex Benth.** [GN]
Aeschynomene histrix **Poir.** [GN]
Aeschynomene histrix **Poir. var.** ***incana*** **Benth.** [GN]
Aeschynomene paniculata **Willd. ex Vogel** [GN]
Aeschynomene pratensis **Small** [GN]
Aeschynomene pratensis **Small var.** ***caribaea*** **Rudd** [GN]
Aeschynomene rudis **Benth.** [GN]
Aeschynomene sensitiva **Sw.** [GN]
Alysicarpus vaginalis **(L.) DC.** [GN]
Andira inermis **(W. Wright) Kunth ex DC.** [GN]
Andira inermis **(W. Wright) Kunth ex DC. subsp.** ***inermis*** [GN]

***Astragalus canadensis* L.** [GN]
***Ateleia gummifera* (DC.) D. Dietr.** [BU]
***Ateleia pterocarpa* D. Dietr.** [GD]
***Barbieria pinnata* (Pers.) Baill.** [GN]
***Cajanus cajan* (L.) Millsp.** [GN]
***Calopogonium caeruleum* (Benth.) C. Wright** [GN]
***Calopogonium galactioides* (Kunth) Hemsl.** [GN]
***Calopogonium mucunoides* Desv.** [GN]
***Canavalia brasiliensis* Mart. ex Benth.** [GN]
***Canavalia oxyphylla* Standl. & L.O. Williams** [GN]
***Canavalia rosea* (Sw.) DC.** [GN]
***Canavalia villosa* Benth.** [GN]
***Centrosema angustifolium* (Kunth) Benth.** [GN]
***Centrosema macrocarpum* Benth.** [GN]
***Centrosema plumieri* (Pers.) Benth.** [GN]
***Centrosema pubescens* Benth.** [GN]
***Centrosema virginianum* (L.) Benth.** [GN]
***Chaetocalyx brasiliensis* (Vogel) Benth.** [GN]
***Clitoria falcata* Lam.** [GN]
***Clitoria guianensis* (Aubl.) Benth.** [GN]
***Clitoria mexicana* Link** [GD]
***Clitoria ternatea* L.** [GN]
Coursetia caribaea* (Jacq.) Lavin var. *caribaea [GN]
***Crotalaria cajanifolia* Kunth** [GN]
***Crotalaria incana* L.** [GN]
***Crotalaria micans* Link** [GN]
***Crotalaria pallida* Aiton** [GN]
***Crotalaria pumila* Ortega** [GN]
***Crotalaria retusa* L.** [GN]
***Crotalaria sagittalis* L.** [GN]
***Crotalaria spectabilis* Roth** [GN]
***Crotalaria verrucosa* L.** [GN]
***Dalbergia brownei* (Jacq.) Schinz** [GN]
***Dalbergia cubilquitzensis* (Donn. Sm.) Pittier** [BU]
***Dalbergia ecastaphyllum* (L.) Taub.** [GN]
***Dalbergia glabra* (Mill.) Standl.** [BU]
***Dalbergia monetaria* L. f.** [GN]
***Dalbergia stevensonii* Standl.** [GD]
***Desmodium adscendens* (Sw.) DC.** [GN]
***Desmodium axillare* (Sw.) DC.** [GN]
***Desmodium axillare* (Sw.) DC. var. *acutifolium* (Kuntze) Urb.** [GN]
Desmodium axillare* (Sw.) DC. var. *axillare [GN]
***Desmodium barbatum* (L.) Benth.** [GN]
***Desmodium distortum* (Aubl.) J.F. Macbr.** [GN]
***Desmodium incanum* DC.** [GN]
***Desmodium intortum* (Mill.) Urb.** [GN]
***Desmodium macrodesmum* (S.F. Blake) Standl. & Steyerm.** [GD]
***Desmodium neomexicanum* A. Gray** [GN]
***Desmodium obtusum* (Muhl. ex Willd.) DC.** [BU]
***Desmodium purpusii* Brandegee** [GN]
***Desmodium scorpiurus* (Sw.) Desv.** [GN]
***Desmodium tortuosum* (Sw.) DC.** [GN]
***Desmodium triflorum* (L.) DC.** [GN]
***Dioclea guianensis* Benth.** [GN]
***Dioclea guianensis* Benth. var. *holtiana* Pittier ex R.H. Maxwell** [GN]
***Dioclea reflexa* Hook.f.** [GN]
***Dioclea virgata* (Rich.) Amshoff** [GN]
***Dioclea wilsonii* Standl.** [GN]
***Diphysa americana* (Mill.) M. Sousa** [GN]
***Diphysa macrophylla* Lundell** [GD]
***Eriosema crinitum* (Kunth) G. Don** [GN]
Eriosema crinitum* (Kunth) G. Don var. *crinitum [GN]
***Eriosema crinitum* (Kunth) G. Don var. *pulchellum* Benth.** [GN]
***Eriosema diffusum* (Kunth) G. Don** [BU]
***Eriosema violaceum* (Aubl.) G. Don** [GN]

Erythrina americana **Mill.** [BU]
Erythrina berteroana **Urb.** [GN]
Erythrina crista-galli **L.** [GN]
Erythrina folkersii **Krukoff & Moldenke** [GD]
Erythrina fusca **Lour.** [GN]
Erythrina standleyana **Krukoff** [GD]
Erythrina variegata **L.** [GN]
Galactia anomala **Lundell** [GD]
Galactia striata **(Jacq.) Urb.** [GN]
Gliricidia sepium **(Jacq.) Kunth ex Walp.** [GN]
Indigofera suffruticosa **Mill.** [GN]
Indigofera tinctoria **L.** [GN]
Indigofera trita **L. f. subsp. *scabra* (Roth) de Kort & G. Thijsse** [GN]
Lablab purpureus **(L.) Sweet** [GN]
Lecointea amazonica **Ducke** [GN]
Lennea melanocarpa **(Schltdl.) Vatke ex Harms** [GD]
Lonchocarpus atropurpureus **Benth.** [GN]
Lonchocarpus castilloi **Standl.** [BU]
Lonchocarpus guatemalensis **Benth.** [BU]
Lonchocarpus heptaphyllus **(Poir.) DC.** [GN]
Lonchocarpus hondurensis **Benth.** [BU]
Lonchocarpus lineatus **Pittier** [GD]
Lonchocarpus luteomaculatus **Pittier** [BU]
Lonchocarpus minimiflorus **Donn. Sm.** [BU]
Lonchocarpus pentaphyllus **(Poir.) DC.** [GD]
Lonchocarpus punctatus **Kunth** [BU]
Lonchocarpus rugosus **Benth.** [BU]
Lonchocarpus rugosus **Benth. subsp. *rugosus*** [GD]
Lonchocarpus santarosanus **Donn. Sm.** [GD]
Lonchocarpus schiedeanus **(Schltdl.) Harms** [BU]
Lonchocarpus subsessilifolius **M. Sousa** [BK]
Lonchocarpus velizii **M. Sousa** [BK]
Lonchocarpus velutinus **Benth.** [GD]
Lonchocarpus xuul **Lundell** [GD]
Machaerium biovulatum **Micheli** [GN]
Machaerium chiapense **Brandegee** [GD]
Machaerium cirrhiferum **Pittier** [BU]
Machaerium conzattii **Rudd** [BK]
Machaerium falciforme **Rudd** [BU]
Machaerium floribundum **Benth.** [GN]
Machaerium isadelphum **(E.Mey.) Amshoff** [GN]
Machaerium kegelii **Meisn.** [GN]
Machaerium myrianthum **Spruce ex Benth.** [BU]
Machaerium riparium **Brandegee** [BU]
Machaerium seemannii **Benth. ex Seemann** [GN]
Macroptilium atropurpureum **(DC.) Urb.** [GN]
Macroptilium gracile **(Benth.) Urb.** [GN]
Macroptilium lathyroides **(L.) Urb.** [GN]
Mucuna argyrophylla **Standl.** [BU]
Mucuna holtonii **(Kuntze) Moldenke** [BU]
Mucuna pruriens **(L.) DC.** [GN]
Mucuna rostrata **Benth.** [GN]
Mucuna sloanei **Fawc. & Rendle** [GN]
Muellera frutescens **(Aubl.) Standl.** [GN]
Myroxylon balsamum **(L.) Harms** [GN]
Myroxylon balsamum **(L.) Harms var. *pereirae* (Royle) Harms** [GN]
Nissolia fruticosa **Jacq.** [GN]
Ormosia isthmensis **Standl.** [BU]
Ormosia macrocalyx **Ducke** [GN]
Ormosia velutina **Rudd** [BU]
Oxyrhynchus trinervius **(Donn. Sm.) Rudd** [GD]
Pachyrhizus erosus **(L.) Urb.** [GN]
Pachyrhizus ferrugineus **(Piper) M. Sørensen** [GN]
Phaseolus lunatus **L.** [GN]
Piscidia piscipula **(L.) Sarg.** [GN]

***Platymiscium dimorphandrum* Donn. Sm.** [BU]
***Platymiscium yucatanum* Standl.** [GD]
***Pterocarpus officinalis* Jacq.** [GN]
***Pterocarpus rohrii* Vahl** [GN]
***Pueraria phaseoloides* (Roxb.) Benth.** [GN]
***Rhynchosia calycosa* Hemsl.** [BU]
***Rhynchosia longeracemosa* M. Martens & Galeotti** [BU]
***Rhynchosia minima* (L.) DC.** [GN]
***Rhynchosia precatoria* (Humb. & Bonpl. ex Willd.) DC.** [GN]
***Rhynchosia pyramidalis* (Lam.) Urb.** [GN]
***Rhynchosia swartzii* (Vail) Urb.** [GD]
***Sesbania exasperata* Kunth** [GN]
***Sesbania herbacea* (Mill.) McVaugh** [GN]
***Sesbania sericea* (Willd.) Link** [GN]
***Sophora tomentosa* L.** [GN]
***Stizolobium pruriens* (L.) Medik.** [GN]
***Stylosanthes guianensis* (Aubl.) Sw.** [GN]
***Stylosanthes humilis* Kunth** [GN]
***Stylosanthes viscosa* Sw.** [GN]
***Swartzia cubensis* (Britton & P. Wilson) Standl.** [BU]
Swartzia cubensis* (Britton & P. Wilson) Standl. var. *cubensis [GD]
***Swartzia myrtifolia* Sm. var. *standleyi* (Britton & Rose) R.S. Cowan** [BU]
***Swartzia simplex* (Sw.) Spreng.** [GN]
***Swartzia simplex* var. *continentalis* Urb.** [GN]
***Tephrosia belizensis* Lundell** [GD]
***Tephrosia multifolia* Rose** [BU]
***Tephrosia nitens* Benth. ex Seem.** [GN]
***Tephrosia rhodantha* Brandegee** [GD]
***Tephrosia senna* Kunth** [GN]
***Teramnus labialis* (L. f.) Spreng.** [GN]
***Vatairea lundellii* (Standl.) Killip ex Record** [BU]
***Vigna adenantha* (G.Mey.) Maréchal, Mascherpa & Stainier** [GN]
***Vigna elegans* (Piper) Maréchal, Mascherpa & Stainier** [GD]
***Vigna lasiocarpa* (Benth.) Verdc.** [GN]
***Vigna linearis* (Kunth) Maréchal, Mascherpa & Stainier** [GN]
***Vigna linearis* (Kunth) Maréchal, Mascherpa & Stainier var. *latifolia* (Benth.) Maréchal, Mascherpa & Stainier** [GN]
***Vigna luteola* (Jacq.) Benth.** [GN]
***Vigna peduncularis* (Kunth) Fawc. & Rendle** [GN]
***Vigna umbellata* (Thunb.) Ohwi & Ohashi** [GN]
***Vigna unguiculata* (L.) Walp.** [GN]
***Vigna vexillata* (L.) A. Rich.** [GN]
***Zornia diphylla* (L.) Pers.** [GN]
***Zornia reticulata* Sm.** [GN]
***Zornia thymifolia* Kunth** [BU]

FABACEAE - MIMOSOIDEAE
***Abarema idiopoda* (S.F. Blake) Barneby & J.W. Grimes** [BU]
***Acacia angustissima* (Mill.) Kuntze** [GN]
***Acacia cedilloi* L. Rico** [BK]
***Acacia collinsii* Saff.** [GN]
***Acacia cookii* Saff.** [BU]
***Acacia cornigera* (L.) Willd.** [GN]
***Acacia dolichostachya* S.F. Blake** [GD]
***Acacia gentlei* Standl.** [GD]
***Acacia globulifera* Saff.** [GD]
***Acacia glomerosa* Benth.** [GN]
***Acacia macracantha* Humb. & Bonpl. ex Willd.** [GN]
***Albizia adinocephala* (Donn. Sm.) Britton & Rose** [BU]
Albizia niopoides* (Benth.) Burkart var. *niopoides [GN]
***Albizia tomentosa* (Micheli) Standl.** [BU]
***Balizia leucocalyx* (Britton & Rose) Barneby & J.W. Grimes** [GD]
***Calliandra belizensis* (Britton & Rose) Standl.** [GD]
***Calliandra calothyrsus* Meisn.** [GN]
***Calliandra grandiflora* (L'Hér.) Benth.** [BU]
***Calliandra houstoniana* (Mill.) Standl.** [BU]

***Calliandra tergemina* (L.) Benth.** [GN]
***Calliandra tergemina* (L.) Benth. var. *emarginata* (Humb. & Bonpl. ex Willd.) Barneby** [GN]
***Chloroleucon mangense* (Jacq.) Britton & Rose** [GN]
***Cojoba arborea* (L.) Britton & Rose** [GN]
Cojoba arborea* (L.) Britton & Rose var. *arborea [GN]
***Cojoba graciliflora* (S.F. Blake) Britton & Rose** [BU]
***Cojoba recordii* Britton & Rose** [GD]
***Desmanthus leptophyllus* Kunth** [GN]
***Desmanthus pubescens* B.L. Turner** [GN]
***Desmanthus virgatus* (L.) Willd.** [GN]
***Entada polystachya* (L.) DC.** [GN]
***Entada rheedei* Spreng.** [GN]
***Enterolobium cyclocarpum* (Jacq.) Griseb.** [GN]
***Havardia albicans* (Kunth) Britton & Rose** [BU]
***Inga acrocephala* Steud.** [GN]
***Inga belizensis* Standl.** [GD]
***Inga cocleensis* Pittier** [GN]
***Inga davidsei* M. Sousa** [GD]
***Inga edulis* Mart.** [GN]
***Inga multijuga* Benth.** [GN]
***Inga nobilis* Willd. subsp. *quaternata* (Poepp.) T.D. Penn.** [GN]
***Inga oerstediana* Benth. ex Seem.** [GN]
***Inga pavoniana* G. Don** [GN]
***Inga pinetorum* Pittier** [GD]
***Inga punctata* Willd.** [GN]
***Inga quaternata* Poepp.** [GN]
***Inga sapindoides* Willd.** [GN]
***Inga thibaudiana* DC.** [GN]
***Inga vera* Willd.** [GN]
***Leucaena diversifolia* (Schltdl.) Benth.** [GN]
***Leucaena leucocephala* (Lam.) de Wit** [GN]
***Lysiloma acapulcense* (Kunth) Benth.** [BU]
***Lysiloma latisiliquum* (L.) Benth.** [GN]
***Mariosousa dolichostachya* (S.F. Blake) Seigler & Ebinger** [BK]
***Mimosa affinis* B.L.Rob.** [BU]
***Mimosa albida* Humb. & Bonpl. ex Willd.** [GN]
***Mimosa albida* Humb. & Bonpl. ex Willd. var. *strigosa* (Willd.) B.L.Rob.** [GN]
***Mimosa asperata* L.** [GN]
***Mimosa bahamensis* Benth.** [BU]
***Mimosa candollei* R. Grether** [GN]
***Mimosa ervendbergii* A. Gray** [BU]
***Mimosa hirsutissima* Mart.** [GN]
***Mimosa hondurana* Britton & Rose** [BU]
***Mimosa occidentalis* Britton & Rose** [GD]
***Mimosa pellita* Humb. & Bonpl. ex Willd.** [GN]
***Mimosa pigra* L.** [GN]
***Mimosa pinetorum* Standl.** [BK]
***Mimosa pudica* L.** [GN]
***Mimosa quadrivalvis* L.** [GN]
***Mimosa somnians* Humb. & Bonpl. ex Willd.** [GN]
Mimosa somnians* Humb. & Bonpl. ex Willd. var. *somnians [GN]
***Mimosa somnians* Humb. & Bonpl. ex Willd. var. *viscida* (Willd.) Barneby** [GN]
***Mimosa tarda* Barneby** [GN]
***Mimosa watsonii* B.L.Rob.** [GN]
***Pithecellobium dulce* (Roxb.) Benth.** [GN]
***Pithecellobium furcatum* Benth.** [GD]
***Pithecellobium hymenaeifolium* (Willd.) Benth.** [BU]
***Pithecellobium johansenii* Standl.** [GD]
***Pithecellobium keyense* Britton** [BU]
***Pithecellobium lanceolatum* (Humb. & Bonpl. ex Willd.) Benth.** [GN]
***Pithecellobium macrandrium* Donn. Sm.** [GD]
***Pithecellobium peckii* S.F. Blake** [BK]
***Pithecellobium unguis-cati* (L.) Benth.** [GN]
***Pithecellobium winzerlingii* Britton & Rose** [GD]
***Samanea saman* (Jacq.) Merr.** [GN]

***Senegalia polyphylla* (DC.) Britton** [GN]
***Sphinga platyloba* (DC.) Barneby & J.W. Grimes** [GN]
***Vachellia cookii* (Saff.) Seigler & Ebinger** [BK]
***Zapoteca formosa* (Kunth) H.M. Hernández** [GN]
Zapoteca formosa* (Kunth) H.M. Hernández subsp. *formosa [GN]
***Zapoteca portoricensis* (Jacq.) H.M. Hernández subsp. *flavida* (Urb.) H.M. Hernández** [GN]
***Zapoteca tetragona* (Willd.) H.M. Hernández** [BU]
***Zygia cognata* (Schltdl. & Cham.) Britton & Rose** [GD]
***Zygia confusa* L. Rico** [GD]
***Zygia conzattii* (Standl.) Britton & Rose** [BU]
***Zygia peckii* (B.L.Rob.) Britton & Rose** [GD]

FAGACEAE
***Quercus acutifolia* Née** [BU]
***Quercus corrugata* Hook.** [GN]
***Quercus cortesii* Liebm.** [GN]
***Quercus elliptica* Née** [GN]
***Quercus flagellifera* Trel.** [GD]
***Quercus insignis* M. Martens & Galeotti** [GN]
***Quercus oleoides* Schltdl. & Cham.** [GN]
***Quercus peduncularis* Née** [BU]
***Quercus purulhana* Trel.** [GD]
***Quercus sapotifolia* Liebm.** [GN]
***Quercus segoviensis* Liebm.** [BU]
***Quercus skinneri* Benth.** [BU]

GELSEMIACEAE
***Gelsemium sempervirens* (L.) J. St.-Hil.** [GN]

GENTIANACEAE
***Centaurium quitense* (Kunth) B.L.Rob.** [GN]
***Centaurium setaceum* (Benth.) B.L.Rob.** [GD]
***Chelonanthus alatus* (Aubl.) Pulle** [GN]
***Coutoubea spicata* Aubl.** [GN]
***Curtia tenella* (Mart.) Cham.** [GN]
***Eustoma exaltatum* (L.) Salisb. ex G. Don** [GN]
***Lisianthius auratus* Standl.** [GD]
***Lisianthius axillaris* (Hemsl.) Kuntze** [GD]
***Lisianthius brevidentatus* (Hemsl.) Kuntze var. *collinus* (Standl.) Weaver** [GD]
***Lisianthius meianthus* Donn. Sm.** [BK]
***Lisianthius saponarioides* Schltdl. & Cham.** [GD]
***Lisianthius skinneri* (Hemsl.) Kuntze** [GN]
***Lisianthius viscidiflorus* B.L.Rob.** [GD]
***Schultesia brachyptera* Cham.** [GN]
***Schultesia guianensis* (Aubl.) Malme** [GN]
***Schultesia lisianthoides* (Griseb.) Benth. & Hook.f. ex Hemsl.** [GN]
***Voyria alba* (Standl.) L.O. Williams** [GN]
***Voyria aphylla* (Jacq.) Pers.** [GN]
***Voyria flavescens* Griseb.** [GN]
***Voyria parasitica* (Schltdl. & Cham.) Ruyters & Maas** [BU]
***Voyria tenella* Hook.** [GN]
***Voyria truncata* (Standl.) Standl. & Steyerm.** [BU]

GESNERIACEAE
***Achimenes erecta* (Lam.) H.P. Fuchs** [BU]
***Amalophyllon rupestre* Brandegee** [GD]
***Besleria laxiflora* Benth.** [GN]
***Codonanthe crassifolia* (H.Focke) C.V. Morton** [GN]
***Codonanthe elegans* Wiehler** [BK]
***Codonanthe macradenia* Donn. Sm.** [BU]
***Codonanthe uleana* Fritsch** [GN]
***Columnea linearis* Oerst.** [BU]
***Columnea purpurata* Hanst.** [BU]
***Columnea sulfurea* Donn. Sm.** [GD]
***Drymonia serrulata* (Jacq.) Mart.** [GN]

***Episcia punctata* (Lindl.) Hanst.** [BK]
***Kohleria spicata* (Kunth) Oerst.** [GN]

GLEICHENIACEAE
***Dicranopteris flexuosa* (Schrad.) Underw.** [GN]
***Dicranopteris pectinata* (Willd.) Underw.** [GN]
***Sticherus palmatus* (J.H. Schaffn. ex Underw.)** [BU]

GOODENIACEAE
***Scaevola plumieri* (L.) Vahl** [GN]

HAEMODORACEAE
***Xiphidium caeruleum* Aubl.** [GN]

HELICONIACEAE
***Heliconia aurantiaca* Ghiesbr.** [BU]
***Heliconia bihai* (L.) L.** [GN]
***Heliconia bourgaeana* Petersen** [GD]
***Heliconia collinsiana* Griggs** [GN]
***Heliconia latispatha* Benth.** [GN]
***Heliconia librata* Griggs** [BU]
***Heliconia mariae* Hook.f.** [GN]
***Heliconia psittacorum* L. f.** [GN]
***Heliconia rostrata* Ruiz & Pav.** [GN]
***Heliconia schiedeana* Klotzsch** [GD]
***Heliconia spissa* Griggs** [GD]
***Heliconia vaginalis* Benth.** [GN]
***Heliconia vaginalis* Benth. subsp. *mathiasiae* (G.S. Daniels & F.G. Stiles) L. Andersson** [BU]
***Heliconia wagneriana* Petersen** [GN]

HERNANDIACEAE
***Sparattanthelium amazonum* Mart.** [GN]

HYDROCHARITACEAE
***Najas wrightiana* A. Braun** [GN]
***Thalassia testudinum* Banks & Sol. ex K.D. Koenig** [GN]

HYDROLEACEAE
***Hydrolea spinosa* L.** [GN]

HYMENOPHYLLACEAE
***Hymenophyllum abruptum* Hook.** [GN]
***Hymenophyllum apiculatum* Mett. ex Kuhn** [GN]
***Hymenophyllum fucoides* (Sw.) Sw.** [GN]
***Hymenophyllum hirsutum* (L.) Sw.** [GN]
***Hymenophyllum polyanthos* Sw.** [GN]
***Hymenophyllum pulchellum* Schltdl. & Cham.** [BU]
***Hymenophyllum sieberi* (C. Presl) Bosch** [GN]
***Trichomanes capillaceum* L.** [GN]
Trichomanes capillaceum* L. var. *capillaceum [GN]
***Trichomanes collariatum* Bosch** [GN]
***Trichomanes crispum* L.** [GN]
***Trichomanes diaphanum* Kunth** [GN]
***Trichomanes diversifrons* (Bory) Mett. ex Sadeb.** [GN]
***Trichomanes ekmanii* Wess. Boer** [GN]
***Trichomanes galeottii* E.Fourn.** [GN]
***Trichomanes godmanii* Hook.** [BU]
***Trichomanes hymenoides* Hedw.** [GN]
***Trichomanes krausii* Hook. & Grev.** [GN]
***Trichomanes membranaceum* L.** [GN]
***Trichomanes ovale* (E.Fourn.) Wess. Boer** [GN]
***Trichomanes pinnatum* Hedw.** [GN]
***Trichomanes polypodioides* L.** [GN]
***Trichomanes punctatum* Poir. subsp. *sphenoides* (Kunze) Wess. Boer** [BU]

***Trichomanes pyxidiferum* L.** [GN]
***Trichomanes rigidum* Sw.** [GN]
***Trichomanes tuerckheimii* H. Christ** [GN]

HYPERICACEAE
***Hypericum aphyllum* Lundell** [BK]
***Hypericum nitidum* Lam.** [GD]
***Hypericum nitidum* Lam. subsp. *cubense* (Turcz.) N.Robson** [GD]
***Hypericum pratense* Schltdl. & Cham.** [BU]
***Hypericum styphelioides* A. Rich.** [GD]
***Hypericum terrae-firmae* Sprague & L. Riley** [BK]
***Vismia baccifera* (L.) Triana & Planch.** [GN]
***Vismia billbergiana* Beurl.** [BU]
***Vismia camparaguey* Sprague & L. Riley** [BU]
***Vismia macrophylla* Kunth** [GN]

HYPOXIDACEAE
***Curculigo scorzonerifolia* (Lam.) Baker** [GN]
***Hypoxis decumbens* L.** [GN]
***Hypoxis humilis* Kunth** [GN]

ICACINACEAE
***Calatola costaricensis* Standl.** [GN]
***Calatola laevigata* Standl.** [GD]
***Calatola uxpanapensis* P. Vera & T. Wendt** [GD]
***Mappia multiflora* Lundell** [BU]
***Ottoschulzia pallida* Lundell** [GD]

IRIDACEAE
***Alophia silvestris* (Loes.) Goldblatt** [BU]
***Cipura campanulata* Ravenna** [GN]
***Cipura paludosa* Aubl.** [GN]
***Neomarica gracilis* (Herb.) Sprague** [GN]
***Neomarica variegata* (M. Martens & Galeotti) Henrich & Goldblatt** [BU]
***Sisyrinchium subcernuum* (E.P. Bicknell) Henrich & Goldblatt** [GD]
***Sisyrinchium tinctorium* Kunth** [GN]

ISOETACEAE
***Isoetes cubana* Engelm. ex Baker** [GD]

JUNCACEAE
***Juncus marginatus* Rostk.** [GN]

KRAMERIACEAE
***Krameria ixine* Loefl.** [BU]

LACISTEMATACEAE
***Lacistema aggregatum* (P.J. Bergius) Rusby** [GN]

LAMIACEAE
***Aegiphila elata* Sw.** [GN]
***Aegiphila martinicensis* Jacq.** [GN]
***Aegiphila monstrosa* Moldenke** [BU]
***Aegiphila pauciflora* Standl.** [GD]
***Callicarpa acuminata* Kunth** [GN]
***Catoferia capitata* (Benth.) Hemsl.** [GD]
***Clerodendrum chinense* (Osbeck) Mabb.** [GN]
***Clerodendrum ligustrinum* (Jacq.) R. Br.** [BU]
***Clerodendrum speciosissimum* C. Morren** [GN]
***Clerodendrum thomsoniae* Balf.** [GN]
***Clerodendrum umbellatum* Poir.** [GN]
***Condea scandens* (Epling) Harley & Pastore** [BK]
***Cornutia pyramidata* L.** [GN]
***Gmelina arborea* Roxb. ex Sm.** [GN]
***Hyptis atrorubens* Poit.** [GN]

***Hyptis brevipes* Poit.** [GN]
***Hyptis capitata* Jacq.** [GN]
***Hyptis conferta* Pohl ex Benth.** [GN]
***Hyptis conferta* Pohl ex Benth. var. *angustata* (Briq.) A. Pool & Harley** [GN]
***Hyptis lantanifolia* Poit.** [GN]
***Hyptis maya* Harley** [BK]
***Hyptis mutabilis* (Rich.) Briq.** [GN]
***Hyptis obtusiflora* C. Presl ex Benth.** [GN]
***Hyptis pectinata* (L.) Poit.** [GN]
***Hyptis recurvata* Poit.** [GN]
***Hyptis suaveolens* (L.) Poit.** [GN]
***Hyptis urticoides* Kunth** [BU]
***Hyptis verticillata* Jacq.** [GN]
***Leonurus japonicus* Houtt.** [GN]
***Marsypianthes chamaedrys* (Vahl) Kuntze** [GN]
***Ocimum basilicum* L.** [GN]
***Ocimum campechianum* Mill.** [GN]
***Plectranthus amboinicus* (Lour.) Spreng.** [GN]
***Salvia coccinea* Buc'hoz ex Etl.** [GN]
***Salvia lasiocephala* Hook. & Arn.** [GN]
***Salvia misella* Kunth** [GN]
***Salvia occidentalis* Sw.** [GN]
***Salvia pansamalensis* Donn. Sm.** [GD]
***Salvia serotina* L.** [GD]
***Salvia urica* Epling** [BU]
***Salvia whitefoordiae* Klitgaard** [BK]
***Scutellaria longifolia* Benth.** [BU]
***Scutellaria lundellii* Epling** [BK]
***Scutellaria orichalcea* Donn. Sm.** [BU]
***Solenostemon scutellarioides* (L.) Codd** [GN]
***Tectona grandis* L. f.** [GN]
***Teucrium vesicarium* Mill.** [GN]
***Vitex cooperi* Standl.** [BU]
***Vitex gaumeri* Greenm.** [BU]
***Vitex hemsleyi* Briq.** [GD]

LAURACEAE
***Beilschmiedia hondurensis* Kosterm.** [GD]
***Beilschmiedia mexicana* (Mez) Kosterm.** [GD]
***Cassytha filiformis* L.** [GN]
***Cinnamomum areolatum* (Lundell) Kosterm.** [GD]
***Cinnamomum triplinerve* (Ruiz & Pav.) Kosterm.** [GN]
***Damburneya coriacea* (Sw.) Trofimov & Rohwer** [BU]
***Licaria campechiana* (Standl.) Kosterm.** [GD]
***Licaria capitata* (Cham. & Schltdl.) Kosterm.** [BU]
***Licaria guatemalensis* Lundell** [GD]
***Licaria misantlae* (Brandegee) Kosterm.** [GD]
***Licaria peckii* (I.M. Johnst.) Kosterm.** [BU]
***Licaria triandra* (Sw.) Kosterm.** [GN]
***Misanteca areolata* Lundell(Lundell)** [BK]
***Nectandra belizensis* (Lundell) C.K. Allen** [GD]
***Nectandra coriacea* (Sw.) Griseb.** [GN]
***Nectandra cuspidata* Nees & Mart.** [GN]
***Nectandra globosa* (Aubl.) Mez** [GN]
***Nectandra hihua* (Ruiz & Pav.) Rohwer** [GN]
***Nectandra longicaudata* (Lundell) C.K. Allen** [GD]
***Nectandra lundellii* C.K. Allen** [GD]
***Nectandra martinicensis* Mez** [GN]
***Nectandra nitida* Mez** [GN]
***Nectandra salicifolia* (Kunth) Nees** [GN]
***Nectandra sanguinea* Rol. ex Rottb.** [BU]
***Nectandra turbacensis* (Kunth) Nees** [GN]
***Ocotea bourgeauviana* (Mez) van der Werff** [GD]
***Ocotea cernua* (Nees) Mez** [GN]
***Ocotea effusa* (Meisn.) Hemsl.** [GD]

Ocotea eucuneata **Lundell** [BK]
Ocotea helicterifolia **(Meisn.) Hemsl.** [BU]
Ocotea leucoxylon **(Sw.) Laness.** [GN]
Ocotea macrophylla **Kunth** [GN]
Ocotea oblonga **(Meisn.) Mez** [GN]
Ocotea rubriflora **Mez** [GD]
Ocotea veraguensis **(Meisn.) Mez** [GN]
Persea americana **Mill.** [GN]
Persea americana **Mill. var. *americana*** [GN]
Persea liebmannii **Mez** [BU]
Persea longipes **(Schltdl.) Meisn.** [GD]
Persea schiedeana **Nees** [BU]
Phoebe trinervis **Lundell** [BK]

LAXMANNIACEAE
Cordyline fruticosa **(L.) A. Chev.** [GN]

LECYTHIDACEAE
Grias cauliflora **L.** [GN]

LENTIBULARIACEAE
Genlisea filiformis **A. St.-Hil.** [GN]
Pinguicula lilacina **Schltdl. & Cham.** [GD]
Utricularia adpressa **Salzm. ex A. St.-Hil. & Girard** [GN]
Utricularia amethystina **Salzm. ex A. St.-Hil. & Girard** [GN]
Utricularia erectiflora **A. St.-Hil. & Girard** [GN]
Utricularia fimbriata **Kunth** [GN]
Utricularia foliosa **L.** [GN]
Utricularia gibba **L.** [GN]
Utricularia guyanensis **A. DC.** [GN]
Utricularia hispida **Lam.** [GN]
Utricularia hydrocarpa **Vahl** [GN]
Utricularia juncea **Vahl** [GN]
Utricularia purpurea **Walter** [GN]
Utricularia pusilla **Vahl** [GN]
Utricularia resupinata **B.D. Greene ex Bigelow** [GN]
Utricularia simulans **Pilg.** [GN]
Utricularia subulata **L.** [GN]
Utricularia viscosa **Spruce ex Oliv.** [GN]

LINDERNIACEAE
Lindernia crustacea **(L.) F.Muell.** [GN]
Lindernia diffusa **(L.) Wettst.** [GN]
Lindernia rotundifolia **(L.) Alston** [GN]

LINDSAEACEAE
Lindsaea klotzschiana **Moritz ex Ettingsh.** [GN]
Lindsaea lancea **(L.) Bedd.** [GN]
Lindsaea lancea **(L.) Bedd. var. *lancea*** [GN]
Lindsaea quadrangularis **Raddi subsp. *subalata* K.U. Kramer** [GN]
Lindsaea stricta **(Sw.) Dryand.** [GN]
Lindsaea stricta **(Sw.) Dryand. var. *stricta*** [GN]
Lonchitis hirsuta **L.** [GN]
Odontosoria schlechtendalii **(C. Presl) C. Chr.** [GD]

LOASACEAE
Mentzelia aspera **L.** [GN]

LOGANIACEAE
Mitreola petiolata **(J.F. Gmel.) Torr. & A. Gray** [GN]
Polypremum procumbens **L.** [GN]
Spigelia anthelmia **L.** [GN]
Spigelia humboldtiana **Cham. & Schltdl.** [GN]
Spigelia palmeri **Rose** [GN]
Spigelia polystachya **Klotzsch ex Progel** [BU]

***Strychnos brachistantha* Standl.** [BU]
***Strychnos panamensis* Seem.** [GN]
***Strychnos panurensis* Sprague & Sandwith** [GN]
***Strychnos peckii* B.L.Rob.** [GN]

LOMARIOPSIDACEAE
***Cyclopeltis semicordata* (Sw.) J.Sm.** [GN]
***Lomariopsis japurensis* (Mart.) J.Sm.** [GN]
***Lomariopsis recurvata* Fée** [GD]
***Lomariopsis vestita* E.Fourn.** [BU]
***Nephrolepis biserrata* (Sw.) Schott** [GN]
***Nephrolepis multiflora* (Roxb.) F.M. Jarrett ex C.V. Morton** [GN]
***Nephrolepis pendula* (Raddi) J.Sm.** [GN]
***Nephrolepis rivularis* (Vahl) Mett. ex Krug** [GN]

LORANTHACEAE
***Oryctanthus cordifolius* (C. Presl) Urb.** [GN]
***Phthirusa pyrifolia* (Kunth) Eichler** [GN]
***Psittacanthus angustifolius* Kuijt** [GD]
***Psittacanthus mayanus* Standl. & Steyerm.** [GD]
***Psittacanthus pinicola* Kuijt** [GD]
***Psittacanthus rhynchanthus* (Benth.) Kuijt** [GN]
***Struthanthus brachybotrys* Standl. & Steyerm.** [BK]
***Struthanthus cassythoides* Millsp. ex Standl.** [BU]
***Struthanthus hartwegii* (Benth.) Standl.** [GD]
***Struthanthus orbicularis* (Kunth) Blume** [GN]

LYCOPODIACEAE
***Huperzia dichaeoides* (Maxon) Holub** [BU]
***Huperzia dichotoma* (Jacq.) Trevis.** [GN]
***Huperzia linifolia* (L.) Trevis.** [GN]
Huperzia linifolia* (L.) Trevis. var. *linifolia [GN]
***Huperzia pithyoides* (Schltdl. & Cham.) Holub** [BU]
Huperzia reflexa* (Lam.) Trevis. var. *reflexa [GN]
***Huperzia taxifolia* (Sw.) Trevis.** [GN]
***Lycopodiella caroliniana* (L.) Pic. Serm.** [GN]
***Lycopodiella caroliniana* (L.) Pic. Serm. var. *meridionalis* (Underw. & F.E. Lloyd) B. Øllg. & P.G. Windisch** [GN]
***Lycopodiella cernua* (L.) Pic. Serm.** [GN]

LYGODIACEAE
***Lygodium heterodoxum* Kunze** [BU]
***Lygodium radiatum* Prantl** [BU]
***Lygodium venustum* Sw.** [GN]
***Lygodium volubile* Sw.** [GN]

LYTHRACEAE
***Ammannia coccinea* Rottb.** [GN]
***Ammannia robusta* Heer & Regel** [BU]
***Cuphea appendiculata* Benth.** [BU]
Cuphea appendiculata* Benth. var. *appendiculata [BU]
***Cuphea aristata* Hemsl.** [BK]
***Cuphea calophylla* Cham. & Schltdl.** [GN]
***Cuphea carthagenensis* (Jacq.) J.F. Macbr.** [GN]
***Cuphea decandra* Aiton** [GD]
***Cuphea hyssopifolia* Kunth** [GN]
***Cuphea mimuloides* Schltdl. & Cham.** [BU]
***Cuphea rotundifolia* Koehne** [GD]
***Cuphea utriculosa* Koehne** [BU]
***Lagerstroemia indica* L.** [GN]
***Lagerstroemia speciosa* (L.) Pers.** [GN]
***Lawsonia inermis* L.** [GN]
***Punica granatum* L.** [GN]
***Rotala ramosior* (L.) Koehne** [GN]

MAGNOLIACEAE

***Magnolia yoroconte* Dandy** [GD]

MALPIGHIACEAE
***Adelphia hiraea* (Gaertn.) W.R. Anderson** [BU]
***Banisteriopsis cornifolia* (Kunth) C.B.Rob.** [BU]
***Banisteriopsis elegans* (Triana & Planch.) Sandwith** [BU]
***Bunchosia lanieri* S. Watson** [GD]
***Bunchosia lindeniana* A. Juss.** [GN]
***Bunchosia nitida* (Jacq.) DC.** [BU]
***Bunchosia swartziana* Griseb.** [BU]
***Byrsonima bucidifolia* Standl.** [GD]
***Byrsonima crassifolia* (L.) Kunth** [GN]
***Callaeum malpighioides* (Turcz.) D.M. Johnson** [GD]
***Galphimia glauca* Cav.** [GN]
***Heteropterys brachiata* (L.) DC.** [GN]
***Heteropterys gentlei* Lundell** [BK]
***Heteropterys laurifolia* (L.) A. Juss.** [GN]
***Heteropterys leona* (Cav.) Exell** [GN]
***Heteropterys lindeniana* A. Juss.** [GD]
***Heteropterys macrostachya* A. Juss.** [GN]
***Hiraea fagifolia* (DC.) A. Juss.** [GN]
***Hiraea obovata* Huber** [GD]
***Hiraea quapara* (Aubl.) Sprague** [BU]
***Hiraea reclinata* Jacq.** [GN]
***Hiraea smilacina* Standl.** [GD]
***Malpighia emarginata* DC.** [GN]
***Malpighia glabra* L.** [GN]
***Malpighia lundellii* C.V. Morton** [BK]
***Malpighia macrocarpa* F.K. Mey.** [GD]
***Malpighia souzae* Miranda** [BK]
***Malpighia spathulifolia* F.K.Mey.** [BU]
***Mascagnia polycarpa* Brandegee** [GD]
***Mascagnia vacciniifolia* Nied.** [GD]
***Psychopterys rivularis* (C.V. Morton & Standl.) W.R. Anderson & S. Corso** [GD]
***Stigmaphyllon ciliatum* (Lam.) A. Juss.** [GN]
***Stigmaphyllon ellipticum* (Kunth) A. Juss.** [GN]
***Stigmaphyllon humboldtianum* (DC.) A. Juss.** [GD]
***Stigmaphyllon lindenianum* A. Juss.** [GN]
***Stigmaphyllon puberum* (Rich.) A. Juss.** [GN]
***Stigmaphyllon retusum* Griseb.** [GN]
***Tetrapterys arcana* C.V. Morton** [BU]
***Tetrapterys discolor* (G.Mey.) DC.** [GN]
***Tetrapterys donnell-smithii* Small** [GD]
***Tetrapterys schiedeana* Schltdl. & Cham.** [BU]
***Tetrapterys seleriana* Nied.** [GD]
***Tetrapterys tinifolia* Triana & Planch.** [BU]

MALVACEAE
***Abelmoschus esculentus* (L.) Moench** [GN]
***Abelmoschus moschatus* Medik.** [GN]
***Abutilon hirtum* (Lam.) Sweet** [GN]
***Abutilon permolle* (Willd.) Sweet** [GD]
***Allosidastrum pyramidatum* (Desp. ex Cav.) Krapov., Fryxell & D.M. Bates** [GN]
***Anoda cristata* (L.) Schltdl.** [GN]
***Bernoullia flammea* Oliv.** [BU]
***Berrya cubensis* (Griseb.) M. Gómez** [GD]
***Briquetia spicata* (Kunth) Fryxell** [GN]
***Byttneria aculeata* (Jacq.) Jacq.** [GN]
***Byttneria catalpifolia* Jacq.** [GN]
***Ceiba aesculifolia* (Kunth) Britton & Baker** [BU]
***Ceiba pentandra* (L.) Gaertn.** [GN]
***Christiana africana* DC.** [GN]
***Corchorus siliquosus* L.** [GN]
***Gossypium barbadense* L.** [GN]
***Gossypium hirsutum* L.** [GN]

***Guazuma ulmifolia* Lam.** [GN]
***Hampea ovatifolia* Lundell** [GD]
***Hampea stipitata* S. Watson** [BU]
***Hampea trilobata* Standl.** [BU]
***Helicteres baruensis* Jacq.** [GN]
***Helicteres guazumifolia* Kunth** [GN]
***Heliocarpus americanus* L.** [GN]
***Heliocarpus donnellsmithii* Rose** [BU]
***Heliocarpus mexicanus* (Turcz.) Sprague** [BU]
***Herissantia crispa* (L.) Brizicky** [GN]
***Hibiscus bifurcatus* Cav.** [GN]
***Hibiscus costatus* A. Rich.** [BU]
***Hibiscus furcellatus* Desr.** [GN]
***Hibiscus pernambucensis* Arruda** [GN]
***Hibiscus rosa-sinensis* L.** [GN]
Hibiscus rosa-sinensis* L. var. *rosa-sinensis [GN]
***Hibiscus rosa-sinensis* L. var. *schizopetalus* Dyer** [GN]
***Hibiscus sabdariffa* L.** [GN]
***Hibiscus schizopetalus* (Mast.) Hook.f.** [GN]
***Hibiscus sororius* L.** [GN]
***Hibiscus trilobus* Aubl.** [BU]
***Luehea seemannii* Triana & Planch.** [GN]
***Luehea speciosa* Willd.** [GN]
***Malachra alceifolia* Jacq.** [GN]
***Malachra capitata* (L.) L.** [GN]
***Malachra fasciata* Jacq.** [GN]
***Malvastrum corchorifolium* (Desr.) Britton ex Small** [BU]
***Malvastrum coromandelianum* (L.) Garcke** [GN]
***Malvaviscus arboreus* Cav.** [GN]
Malvaviscus arboreus* Cav. var. *arboreus [GN]
***Malvaviscus arboreus* Cav. var. *mexicanus* Schltdl.** [GN]
***Malvaviscus penduliflorus* DC.** [GN]
***Melochia lupulina* Sw.** [GN]
***Melochia melissifolia* Benth.** [GN]
***Melochia nodiflora* Sw.** [GN]
***Melochia pyramidata* L.** [GN]
***Melochia spicata* (L.) Fryxell** [GN]
***Melochia tomentosa* L.** [GN]
***Melochia villosa* (Mill.) Fawc. & Rendle** [GN]
***Mortoniodendron vestitum* Lundell** [GD]
***Muntingia calabura* L.** [GN]
***Ochroma pyramidale* (Lam.) Urb.** [GN]
***Pachira aquatica* Aubl.** [GN]
***Pavonia malacophylla* (Link & Otto) Garcke** [GN]
***Pavonia paludicola* Nicolson ex Fryxell** [GN]
***Pavonia paniculata* Cav.** [GN]
***Pavonia rosea* Wall. ex Moris** [GN]
***Pavonia schiedeana* Steud.** [GN]
***Petenaea cordata* Lundell** [GD]
***Pseudobombax ellipticoideum* A.Robyns** [GD]
***Pseudobombax ellipticum* (Kunth) Dugand** [BU]
***Pseudobombax septenatum* (Jacq.) Dugand** [GN]
***Quararibea funebris* (La Llave) Vischer** [GD]
Quararibea funebris* (La Llave) Vischer subsp. *funebris [BU]
***Quararibea yunckeri* Standl.** [GD]
Quararibea yunckeri* Standl. subsp. *yunckeri [GD]
Robinsonella lindeniana* (Rose & Baker f.) Fryxell subsp. *divergens [GD]
***Sida acuta* Burm. f.** [GN]
***Sida ciliaris* L.** [GN]
***Sida glabra* Mill.** [GN]
***Sida linifolia* Juss. ex Cav.** [GN]
***Sida rhombifolia* L.** [GN]
***Sida ulmifolia* Mill.** [GN]
***Sida urens* L.** [GN]
***Sterculia mexicana* R. Br.** [GD]

***Talipariti tiliaceum* (L.) Fryxell** [GN]
***Theobroma bicolor* Bonpl.** [GN]
***Theobroma cacao* L.** [GN]
***Thespesia populnea* (L.) Sol. ex Corrêa** [GN]
***Trichospermum grewiifolium* (A. Rich.) Kosterm.** [GN]
***Trichospermum lessertianum* (Hochr.) Dorr** [GD]
***Trichospermum mexicanum* (DC.) Baill.** [GN]
***Triumfetta bogotensis* DC.** [GN]
***Triumfetta calderonii* Standl.** [BU]
***Triumfetta discolor* Rose** [GD]
***Triumfetta lappula* L.** [GN]
***Triumfetta rhomboidea* Jacq.** [GN]
***Triumfetta semitriloba* Jacq.** [GN]
***Triumfetta speciosa* Seem.** [BU]
***Urena lobata* L.** [GN]
***Waltheria indica* L.** [GN]
***Wissadula amplissima* (L.) R.E. Fr.** [GN]
***Wissadula excelsior* (Cav.) C. Presl** [GN]

MARANTACEAE
***Calathea crotalifera* S. Watson** [GN]
***Calathea inocephala* (Kuntze) H. Kenn. & Nicolson** [GN]
***Calathea lutea* (Aubl.) Schult.** [GN]
Calathea macrosepala* K. Schum. var. *macrosepala [GD]
***Calathea marantifolia* Standl.** [BU]
***Calathea micans* (L. Mathieu) Körn.** [GN]
***Calathea microcephala* (Poepp. & Endl.) Körn.** [GN]
***Maranta arundinacea* L.** [GN]
***Maranta gibba* Sm.** [GN]
***Pleiostachya pruinosa* (Regel) K. Schum.** [GN]
***Stromanthe hjalmarssonii* (Körn.) Petersen ex K. Schum.** [BU]
***Stromanthe tonckat* (Aubl.) Eichler** [GN]
***Thalia geniculata* L.** [GN]

MARATTIACEAE
***Danaea elliptica* Sm.** [GN]
***Danaea nodosa* (L.) Sm.** [GN]
***Marattia excavata* Underw.** [BU]

MARCGRAVIACEAE
***Marcgravia brownei* (Triana & Planch.) Krug & Urb.** [GN]
***Marcgravia gentlei* Lundell** [GD]
***Marcgravia mexicana* Gilg** [BU]
***Marcgravia nepenthoides* Seem.** [BU]
***Marcgravia schippii* Standl.** [GN]
***Ruyschia enervia* Lundell** [GD]
***Souroubea gilgii* V.A. Richt.** [BU]
***Souroubea loczyi* (V.A. Richt.) de Roon** [GD]
Souroubea loczyi* (V.A. Richt.) de Roon subsp. *loczyi [GD]
***Souroubea sympetala* Gilg** [GN]

MARTYNIACEAE
***Martynia annua* L.** [GN]

MAYACACEAE
***Mayaca fluviatilis* Aubl.** [GN]

MELASTOMATACEAE
***Aciotis indecora* (Bonpl.) Triana** [GN]
***Aciotis rubricaulis* (Mart. ex DC.) Triana** [GN]
***Acisanthera bivalvis* (Aubl.) Cogn.** [GN]
***Acisanthera crassipes* (Naudin) Wurdack** [GN]
***Acisanthera quadrata* Pers.** [GN]
***Adelobotrys adscendens* (Sw.) Triana** [GN]
***Arthrostemma ciliatum* Pav. ex D. Don** [GN]

***Arthrostemma parvifolium* Cogn.** [GD]
***Bellucia grossularioides* (L.) Triana** [GN]
***Bellucia pentamera* Naudin** [GN]
***Blakea calycularis* (Naudin) Penneys & Almeda** [GD]
***Blakea cuneata* Standl.** [GD]
***Clidemia capitellata* (Bonpl.) D. Don** [GN]
Clidemia capitellata* (Bonpl.) D. Don var. *capitellata [GN]
***Clidemia capitellata* (Bonpl.) D. Don var. *dependens* (Pav. ex D. Don) J.F. Macbr.** [GN]
***Clidemia crenulata* Gleason** [BU]
***Clidemia cymifera* Donn. Sm.** [GD]
***Clidemia densiflora* (Standl.) Gleason** [BU]
***Clidemia dentata* Pav. ex D. Don** [GN]
***Clidemia hirta* (L.) D. Don** [GN]
***Clidemia involucrata* DC.** [GN]
***Clidemia laxiflora* (Schltdl.) Walp. ex Naudin** [GD]
***Clidemia monantha* L.O. Williams** [BU]
***Clidemia novemnervia* (DC.) Triana** [BU]
***Clidemia octona* (Bonpl.) L.O. Williams** [GN]
***Clidemia petiolaris* (Schltdl. & Cham.) Schltdl. ex Triana** [BU]
***Clidemia pustulata* DC.** [GN]
***Clidemia rubra* (Aubl.) Mart.** [GN]
***Clidemia septuplinervia* Cogn.** [GN]
***Clidemia sericea* D. Don** [GN]
***Clidemia strigillosa* (Sw.) DC.** [GN]
***Clidemia urceolata* DC.** [GN]
***Conostegia caelestis* Standl.** [BU]
***Conostegia icosandra* (Sw. ex Wikstr.) Urb.** [GN]
***Conostegia montana* (Sw.) D. Don ex DC.** [GN]
***Conostegia plumosa* L.O. Williams** [GD]
***Conostegia xalapensis* (Bonpl.) D. Don ex DC.** [BU]
***Graffenrieda galeottii* (Naudin) L.O. Williams** [BU]
***Graffenrieda gentlei* Lundell** [GD]
***Henriettea strigosa* Gleason** [GD]
***Henriettea succosa* (Aubl.) DC.** [GN]
***Henriettella fascicularis* (Sw.) C. Wright** [GD]
***Heterocentron subtriplinervium* (Link & Otto) A. Braun & C. D. Bouché** [GN]
***Leandra dichotoma* (D. Don) Cogn.** [GN]
***Leandra mexicana* (Naudin) Cogn.** [BU]
***Miconia affinis* DC.** [GN]
***Miconia albicans* (Sw.) Steud.** [GN]
***Miconia ampla* Triana** [GN]
***Miconia argentea* (Sw.) DC.** [GN]
***Miconia astroplocama* Donn. Sm.** [GN]
***Miconia bubalina* (D. Don) Naudin** [GN]
***Miconia calvescens* DC.** [GN]
***Miconia centrodesma* Naudin** [GN]
***Miconia chamissois* Naudin** [GN]
***Miconia chrysophylla* (Rich.) Urb.** [GN]
***Miconia ciliata* (Rich.) DC.** [GN]
***Miconia desmantha* Benth.** [GN]
***Miconia dodecandra* (Desr.) Cogn.** [GN]
***Miconia dorsiloba* Gleason** [GN]
***Miconia elata* (Sw.) DC.** [GN]
***Miconia fulvostellata* L.O. Williams** [GD]
***Miconia glaberrima* (Schltdl.) Naudin** [GN]
***Miconia gracilis* Triana** [GN]
***Miconia holosericea* (L.) DC.** [GN]
***Miconia hondurensis* Donn. Sm.** [BU]
***Miconia hyperprasina* Naudin** [GN]
***Miconia ibaguensis* (Bonpl.) Triana** [GN]
***Miconia impetiolaris* (Sw.) D. Don ex DC.** [GN]
Miconia impetiolaris* (Sw.) D. Don ex DC. var. *impetiolaris [GN]
***Miconia insularis* Gleason** [BU]
***Miconia lacera* (Bonpl.) Naudin** [GN]
***Miconia laevigata* (L.) D. Don** [GN]

***Miconia lateriflora* Cogn.** [GN]
***Miconia longifolia* (Aubl.) DC.** [GN]
***Miconia matthaei* Naudin** [GN]
***Miconia minutiflora* (Bonpl.) DC.** [GN]
***Miconia mirabilis* (Aubl.) L.O. Williams** [GN]
***Miconia nervosa* (Sm.) Triana** [GN]
***Miconia nutans* Donn. Sm.** [GN]
***Miconia oinochrophylla* Donn. Sm.** [BU]
***Miconia oligocephala* Donn. Sm.** [GD]
***Miconia paleacea* Cogn.** [GN]
***Miconia prasina* (Sw.) DC.** [GN]
***Miconia punctata* (Desr.) D. Don ex DC.** [GN]
***Miconia reducens* Triana** [GN]
***Miconia schippii* Standl.** [BU]
***Miconia schlechtendalii* Cogn.** [BU]
***Miconia schlimii* Triana** [BU]
***Miconia serrulata* (DC.) Naudin** [GN]
***Miconia smaragdina* Naudin** [GN]
***Miconia splendens* (Sw.) Griseb.** [GN]
***Miconia stenostachya* DC.** [GN]
***Miconia tomentosa* (Rich.) D. Don ex DC.** [GN]
***Miconia triplinervis* Ruiz & Pav.** [GN]
***Mouriri exilis* Gleason** [BU]
***Mouriri myrtilloides* (Sw.) Poir.** [GN]
***Mouriri myrtilloides* (Sw.) Poir. subsp. *parvifolia* (Benth.) Morley** [GN]
***Nepsera aquatica* (Aubl.) Naudin** [GN]
***Ossaea micrantha* (Sw.) Macfad. ex Cogn.** [BU]
***Pachyanthus lundellianus* (L.O. Williams) Judd & Skean** [GD]
***Pterolepis stenophylla* Gleason** [GD]
***Tibouchina aspera* Aubl.** [GN]
***Tibouchina longifolia* (Vahl) Baill.** [GN]
***Tibouchina schiedeana* (Schltdl. & Cham.) Cogn.** [GD]
***Tococa guianensis* Aubl.** [GN]
***Topobea laevigata* (D. Don) Naudin** [GD]
***Topobea watsonii* Cogn.** [GN]

MELIACEAE
***Carapa guianensis* Aubl.** [GN]
***Cedrela odorata* L.** [GN]
***Guarea bijuga* C. DC.** [GD]
***Guarea glabra* Vahl** [GN]
***Guarea glabra* subsp. *rovirosae* (C. DC.) T.D. Penn.** [GN]
Guarea glabra* (C. DC.) T.D. Penn. subsp. *tuerckheimii [GN]
***Melia azedarach* L.** [GN]
***Swietenia macrophylla* King** [GN]
***Trichilia breviflora* S.F. Blake & Standl.** [GD]
***Trichilia erythrocarpa* Lundell** [GD]
***Trichilia glabra* L.** [BU]
***Trichilia havanensis* Jacq.** [GN]
***Trichilia hirta* L.** [GN]
***Trichilia martiana* C. DC.** [GN]
***Trichilia minutiflora* Standl.** [GD]
***Trichilia moschata* Sw.** [GN]
***Trichilia pallida* Sw.** [GN]
***Trichilia quadrijuga* Kunth** [GN]

MENISPERMACEAE
***Abuta panamensis* (Standl.) Krukoff & Barneby** [BU]
***Abuta steyermarkii* (Standl.) Standl.** [GD]
***Cissampelos pareira* L.** [GN]
***Cissampelos tropaeolifolia* DC.** [GN]
***Disciphania calocarpa* Standl.** [BU]
***Hyperbaena mexicana* Miers** [BU]
***Hyperbaena winzerlingii* Standl.** [GD]

MENYANTHACEAE
***Nymphoides indica* (L.) Kuntze** [GN]

METAXYACEAE
***Metaxya rostrata* (Kunth) C. Presl** [GN]

MOLLUGINACEAE
***Mollugo verticillata* L.** [GN]

MONIMIACEAE
***Mollinedia viridiflora* Tul.** [BU]

MORACEAE
***Artocarpus altilis* (Parkinson) Fosberg** [GN]
***Brosimum alicastrum* Sw.** [GN]
Brosimum alicastrum* Sw. subsp. *alicastrum [GN]
***Brosimum guianense* (Aubl.) Huber** [GN]
***Brosimum lactescens* (S.Moore) C.C. Berg** [GN]
***Castilla elastica* Sessé** [GN]
***Castilla tunu* Hemsl.** [BU]
***Dorstenia belizensis* C.C. Berg** [BK]
***Dorstenia contrajerva* L.** [GN]
***Dorstenia lindeniana* Bureau** [GD]
***Ficus americana* Aubl.** [GN]
***Ficus apollinaris* Dugand** [GN]
***Ficus aurea* Nutt.** [BU]
***Ficus citrifolia* Mill.** [GN]
***Ficus colubrinae* Standl.** [BU]
***Ficus costaricana* (Liebm.) Miq.** [BU]
***Ficus cotinifolia* Kunth** [GN]
***Ficus crassinervia* Desf. ex Willdenow** [BU]
***Ficus crassiuscula* Warb. ex Standl.** [GN]
***Ficus donnell-smithii* Standl.** [GN]
***Ficus elastica* Roxb. ex Hornem.** [GN]
***Ficus insipida* Willd.** [GN]
***Ficus maxima* Mill.** [GN]
***Ficus obtusifolia* Kunth** [GN]
***Ficus paraensis* (Miq.) Miq.** [GN]
***Ficus pertusa* L. f.** [GN]
***Ficus popenoei* Standl.** [GN]
***Ficus schippii* Standl.** [GN]
***Ficus tonduzii* Standl.** [GN]
***Ficus trigonata* L.** [GN]
***Ficus turrialbana* W.C. Burger** [GN]
***Ficus velutina* Humb. & Bonpl. ex Willd.** [GN]
***Ficus yoponensis* Desv.** [GN]
***Morus alba* L.** [GN]
***Naucleopsis capirensis* C.C. Berg** [BU]
***Poulsenia armata* (Miq.) Standl.** [GN]
***Pseudolmedia glabrata* (Liebm.) C.C. Berg** [BU]
***Pseudolmedia spuria* (Sw.) Griseb.** [BU]
***Trophis mexicana* (Liebm.) Bureau** [BU]
***Trophis racemosa* (L.) Urb.** [GN]

MORINGACEAE
***Moringa oleifera* Lam.** [GN]

MYRICACEAE
***Morella cerifera* (L.) Small** [GN]
***Myrica cerifera* L.** [GN]

MYRISTICACEAE
***Compsoneura mexicana* (Hemsl.) Janovec** [BU]
***Compsoneura sprucei* (A. DC.) Warb.** [GN]
***Virola koschnyi* Warb.** [BU]

***Virola multiflora* (Standl.) A.C.Sm.** [BU]

MYRSINACEAE
***Anagallis pumila* Sw.** [GN]
***Ardisia bracteosa* A. DC.** [BU]
***Ardisia compressa* Kunth** [GN]
***Ardisia escallonioides* Schltdl. & Cham.** [BU]
***Ardisia guianensis* (Aubl.) Mez** [GN]
***Ardisia hintonii* Lundell** [GD]
***Ardisia nigrescens* Oerst.** [GD]
***Ardisia nigropunctata* Oerst.** [BU]
***Ardisia paschalis* Donn. Sm.** [BU]
***Ardisia schippii* Standl.** [BK]
***Ardisia tuerckheimii* Donn. Sm.** [GD]
***Gentlea micranthera* (Donn. Sm.) Lundell** [BU]
***Parathesis cubana* (A. DC.) Molinet & M. Gómez** [BU]
***Parathesis donnell-smithii* Mez** [BU]
***Parathesis rufa* Lundell** [BK]
***Parathesis sessilifolia* Donn. Sm.** [GD]
***Stylogyne turbacensis* subsp. *laevis* (Oerst.) Ricketson & Pipoly** [BU]

MYRTACEAE
***Callistemon viminalis* (Sol. ex Gaertn.) G. Don** [GN]
***Calyptranthes bartlettii* Standl.** [BK]
***Calyptranthes calderonii* Standl.** [GD]
***Calyptranthes chytraculia* (L.) Sw.** [BU]
***Calyptranthes chytraculia* (L.) Sw. var. *americana* McVaugh** [BU]
***Calyptranthes cuneifolia* Lundell** [BK]
***Calyptranthes hondurensis* Standl.** [GD]
***Calyptranthes karlingii* Standl.** [GD]
***Calyptranthes lindeniana* O. Berg** [GD]
***Calyptranthes megistophylla* Standl.** [GD]
***Calyptranthes millspaughii* Urb.** [GD]
***Calyptranthes pallens* Griseb.** [GN]
***Calyptranthes petenensis* Lundell** [BK]
***Chamguava gentlei* (Lundell) Landrum** [BK]
***Chamguava gentlei* (Lundell) Landrum var. *apodantha* (Standl.) Landrum** [GD]
Chamguava gentlei* (Lundell) Landrum var. *gentlei [BK]
***Chamguava schippii* (Standl.) Landrum** [GD]
***Eugenia acapulcensis* Steud.** [GN]
***Eugenia aeruginea* DC.** [GN]
***Eugenia ardisioides* Lundell** [BK]
***Eugenia axillaris* (Sw.) Willd.** [BU]
***Eugenia biflora* (L.) DC.** [GN]
***Eugenia bumelioides* Standl.** [GD]
***Eugenia capuli* (Schltdl. & Cham.) Hook. & Arn.** [BU]
Eugenia capuli* (Schltdl. & Cham.) Hook. & Arn. var. *capuli [BU]
***Eugenia cayoana* Lundell** [BK]
***Eugenia chahalana* Lundell** [GD]
***Eugenia chinajensis* Standl. & Steyerm.** [BK]
***Eugenia choapamensis* Standl.** [GD]
***Eugenia farameoides* A. Rich.** [BU]
***Eugenia flavoviridis* Lundell** [GD]
***Eugenia foetida* Pers.** [GN]
***Eugenia galalonensis* (C. Wright ex Griseb.) Krug & Urb.** [GN]
***Eugenia gaumeri* Standl.** [GD]
***Eugenia ibarrae* Lundell** [GD]
***Eugenia karwinskyana* O. Berg** [BU]
***Eugenia laevis* O. Berg** [GD]
***Eugenia ligustrina* (Sw.) Willd.** [GN]
***Eugenia oerstediana* O. Berg** [GN]
***Eugenia percivalii* Lundell** [BK]
***Eugenia rhombea* (O. Berg) Krug & Urb.** [GN]
***Eugenia riograndis* Lundell** [GD]
***Eugenia rufidula* Lundell** [BK]

Eugenia savannarum **Standl. & Steyerm.** [GD]
Eugenia tikalana **Lundell** [GD]
Eugenia toledinensis **Lundell** [BK]
Eugenia trikii **Lundell** [GD]
Eugenia uniflora **L.** [GN]
Eugenia vacana **Lundell** [BK]
Eugenia venezuelensis **O. Berg** [BU]
Eugenia winzerlingii **Standl.** [GD]
Melaleuca leucadendra **(L.) L.** [GN]
Myrcia amazonica **DC.** [GN]
Myrcia splendens **(Sw.) DC.** [GN]
Myrcianthes fragrans **(Sw.) McVaugh** [GN]
Myrciaria floribunda **(H. West ex Willd.) O. Berg** [GN]
Pimenta dioica **(L.) Merr.** [GN]
Plinia peroblata **(Lundell) Lundell** [BK]
Psidium guajava **L.** [GN]
Psidium guineense **Sw.** [GN]
Psidium oligospermum **DC.** [GN]
Psidium salutare **(Kunth) O. Berg** [GN]
Psidium sartorianum **(O. Berg) Nied.** [GN]
Syzygium cumini **(L.) Skeels** [GN]
Syzygium jambos **(L.) Alston** [GN]
Syzygium malaccense **(L.) Merr. & L.M. Perry** [GN]

NYCTAGINACEAE
Boerhavia coccinea **Mill.** [GN]
Boerhavia diffusa **L.** [GN]
Boerhavia erecta **L.** [GN]
Bougainvillea buttiana **Holttum & Standl.** [GN]
Guapira linearibracteata **(Heimerl) Lundell** [GD]
Mirabilis jalapa **L.** [GN]
Neea acuminatissima **Standl.** [GD]
Neea choriophylla **Standl.** [BU]
Neea fagifolia **Heimerl** [BU]
Neea psychotrioides **Donn. Sm.** [BU]
Pisonia aculeata **L.** [GN]
Pisonia proctorii **Lundell** [BK]

NYMPHAEACEAE
Nymphaea ampla **(Salisb.) DC.** [GN]
Nymphaea ampla **var.** ***speciosa*** **(Mart. & Zucc.) Casp.** [GN]
Nymphaea conardii **Wiersema** [GN]

OCHNACEAE
Elvasia bisepala **Sastre & Whitef.** [BK]
Ouratea insulae **L. Riley** [GD]
Ouratea lucens **(Kunth) Engl.** [GN]
Ouratea nitida **(Sw.) Engl.** [GN]
Ouratea pyramidalis **L. Riley** [GD]
Sauvagesia erecta **L.** [GN]
Sauvagesia erecta **L. subsp.** ***brownei*** **(Planch.) Sastre** [GN]
Sauvagesia erecta **L. subsp.** ***erecta*** [GN]
Sauvagesia tenella **Lam.** [GN]

OLACACEAE
Heisteria media **S.F. Blake** [BU]
Schoepfia schreberi **J.F. Gmel.** [GN]
Ximenia americana **L.** [GN]

OLEACEAE
Chionanthus lanceolatus **(Knobl.) J. Jiménez Alm.** [BK]
Chionanthus oblanceolatus **(B.L.Rob.) P.S.Green** [GD]
Chionanthus panamensis **(Standl.) Stearn** [BU]
Forestiera rhamnifolia **Griseb. var.** ***rhamnifolia*** [BU]

***Jasminum fluminense* Vell.** [GN]
***Jasminum grandiflorum* L.** [GN]
***Jasminum multiflorum* (Burm. f.) Andrews** [GN]
***Jasminum sambac* (L.) Aiton** [GN]

OLEANDRACEAE
***Oleandra articulata* (Sw.) C. Presl** [GN]
***Oleandra pilosa* Hook.** [GN]

ONAGRACEAE
***Hauya elegans* DC. subsp. *lucida* (Donn. Sm. & Rose) P.H. Raven & Breedlove** [BU]
***Ludwigia affinis* (DC.) H. Hara** [GN]
***Ludwigia erecta* (L.) H. Hara** [GN]
***Ludwigia helminthorrhiza* (Mart.) H. Hara** [GN]
***Ludwigia nervosa* (Poir.) H. Hara** [GN]
***Ludwigia octovalvis* (Jacq.) P.H. Raven** [GN]
***Ludwigia peploides* (Kunth) P.H. Raven** [GN]
***Ludwigia peruviana* (L.) H. Hara** [GN]
***Ludwigia torulosa* (Arn.) H. Hara** [GN]

OPHIOGLOSSACEAE
***Cheiroglossa palmata* (L.) C. Presl** [BU]
***Ophioglossum nudicaule* L. f.** [GN]

ORCHIDACEAE
***Acianthera angustifolia* (Lindl.) Luer** [GD]
***Acianthera angustisepala* (Ames & Correll) Pridgeon & M.W. Chase** [BK]
***Acianthera hondurensis* (Ames) Pridgeon & M.W. Chase** [GD]
***Acianthera tikalensis* (Correll & C. Schweinf.) Pridgeon & M.W. Chase** [BK]
***Beloglottis costaricensis* (Rchb.) Schltr.** [GN]
***Bletia purpurea* (Lam.) DC.** [GN]
***Brassavola nodosa* (L.) Lindl.** [GN]
***Brassavola venosa* Lindl.** [GD]
***Brassia caudata* (L.) Lindl.** [GN]
***Brassia maculata* R. Br.** [BU]
***Bulbophyllum pachyrachis* (A. Rich.) Griseb.** [GN]
***Campylocentrum fasciola* (Lindl.) Cogn.** [GN]
***Campylocentrum hondurense* Ames** [BU]
***Campylocentrum micranthum* (Lindl.) Rolfe** [GN]
***Campylocentrum poeppigii* (Rchb.) Rolfe** [GN]
***Campylocentrum tyrridion* Garay & Dunst. ex Foldats** [BU]
***Catasetum integerrimum* Hook.** [BU]
***Cattleya bowringiana* Veitch** [BK]
***Cattleya skinneri* Bateman** [BU]
***Caularthron bilamellatum* (Rchb.) R.E. Schult.** [GN]
***Chysis laevis* Lindl.** [GD]
***Clowesia russelliana* (Hook.) Dodson** [GN]
***Coelia bella* (Lem.) Rchb.** [GD]
***Coryanthes picturata* Rchb.** [GD]
***Corymborkis forcipigera* (Rchb. f. & Warsz.) L.O. Williams** [GN]
***Cranichis sylvatica* A. Rich. & Galeotti** [GD]
***Cryptarrhena guatemalensis* Schltr.** [GN]
***Cryptarrhena lunata* R. Br.** [GN]
***Cyclopogon comosus* (Rchb.) Burns-Bal. & E.W. Greenw.** [GD]
***Cyclopogon cranichoides* (Griseb.) Schltr.** [GN]
***Cycnoches ventricosum* Bateman** [GD]
***Cyrtopodium punctatum* (L.) Lindl.** [GN]
***Dichaea glauca* (Sw.) Lindl.** [BU]
***Dichaea hystricina* Rchb. f.** [GN]
***Dichaea lankesteri* Ames** [GD]
***Dichaea muricatoides* Hamer & Garay** [BU]
***Dichaea neglecta* Schltr.** [GN]
***Dichaea panamensis* Lindl.** [GN]
***Dichaea trulla* Rchb. f.** [GN]
***Dimerandra emarginata* (G.Mey.) Hoehne** [GN]

***Dinema polybulbon* (Sw.) Lindl.** [BU]
***Dresslerella powellii* (Ames) Luer** [GD]
***Elleanthus caricoides* Nash** [BU]
***Elleanthus cynarocephalus* Rchb. f.(Rchb. f.)** [BU]
***Elleanthus graminifolius* (Barb. Rodr.) Løjtnant** [GN]
***Elleanthus linifolius* C. Presl** [GN]
***Encyclia alata* (Bateman) Schltr.** [GN]
***Encyclia amanda* (Ames) Dressler & G.E. Pollard** [BU]
***Encyclia belizensis* (Rchb. f.) Schltr.** [GD]
***Encyclia belizensis* (Rchb. f.) Schltr. subsp. *parviflora* Dressler & G.E. Pollard** [GD]
***Encyclia bractescens* (Lindl.) Hoehne** [BU]
***Encyclia guatemalensis* (Klotzsch) Dressler & G.E. Pollard** [BU]
***Encyclia peraltensis* (Ames) Dressler** [GD]
***Epidendrum cardiophorum* Schltr.** [BU]
***Epidendrum cristatum* Ruiz & Pav.** [GN]
***Epidendrum cystosum* Ames** [BU]
***Epidendrum flexuosum* G.Mey.** [GN]
***Epidendrum glumarum* Hamer & Garay** [GD]
***Epidendrum isomerum* Schltr.** [GN]
***Epidendrum isthmi* Schltr.** [GD]
***Epidendrum macroclinium* Hágsater** [GD]
***Epidendrum martinezii* L. Sánchez S. & Carnevali** [GD]
***Epidendrum nitens* Rchb.** [GD]
***Epidendrum nocturnum* Jacq.** [GN]
***Epidendrum paranthicum* Rchb.** [GD]
***Epidendrum ramosum* Jacq.** [GN]
***Epidendrum sculptum* Rchb. f.** [GN]
***Epidendrum stamfordianum* Bateman** [GN]
***Epidendrum strobiliferum* Rchb. f.** [GN]
***Epidendrum veroscriptum* Hágsater** [GD]
***Epistephium ellipticum* R.O. Williams & Summerh.** [GN]
***Eriopsis biloba* Lindl.** [BU]
***Eulophia alta* (L.) Fawc. & Rendle** [GN]
***Eurystyles borealis* A.H. Heller** [GD]
***Galeandra arundinis* Garay & G.A. Romero** [GD]
***Gongora leucochila* Lem.** [GD]
***Gongora unicolor* Schltr.** [GD]
***Habenaria bacata* Dressler** [BK]
***Habenaria brownelliana* Catling** [GD]
***Habenaria distans* Griseb.** [GN]
***Habenaria leprieurii* Rchb. f.** [GN]
***Habenaria mesodactyla* Griseb.** [GN]
***Habenaria monorrhiza* (Sw.) Rchb. f.** [GN]
***Habenaria repens* Nutt.** [GN]
***Habenaria rodeiensis* Barb. Rodr.** [GN]
***Habenaria trifida* Kunth** [GN]
***Habenaria wercklei* Schltr.** [GD]
***Ionopsis satyrioides* (Sw.) Rchb. f.** [GN]
***Ionopsis utricularioides* (Sw.) Lindl.** [GN]
***Isochilus carnosiflorus* Lindl.** [GD]
***Jacquiniella equitantifolia* (Ames) Dressler** [GN]
***Jacquiniella globosa* (Jacq.) Schltr.** [GN]
***Jacquiniella teretifolia* (Sw.) Britton & P. Wilson** [GN]
***Kegeliella kupperi* Mansf.** [GD]
***Koellensteinia kellneriana* Rchb. f.** [BU]
***Kraenzlinella erinacea* (Rchb. f.) Solano** [GD]
***Laelia rubescens* Lindl.** [BU]
***Lepanthes johnsonii* Ames** [BU]
***Lepanthopsis floripecten* (Rchb.) Ames** [GN]
***Lockhartia hercodonta* Rchb. f. ex Kraenzl.** [BU]
***Lockhartia pittieri* Schltr.** [GN]
***Lycaste aromatica* (Graham ex Hook.) Lindl.** [BU]
***Lycaste leucantha* (Klotzsch) Lindl.** [GD]
***Macradenia brassavolae* Rchb. f.** [GN]
***Masdevallia adamsii* Luer** [BK]

Masdevallia floribunda **Lindl.** [BU]
Masdevallia tubuliflora **Ames** [GD]
Maxillaria aciantha **Rchb. f.** [GN]
Maxillaria cobanensis **Schltr.** [BU]
Maxillaria confusa **Ames & C. Schweinf.** [BU]
Maxillaria crassifolia **(Lindl.) Rchb.** [GN]
Maxillaria cucullata **Lindl.** [BU]
Maxillaria densa **Lindl.** [BU]
Maxillaria elatior **Rchb.** [BU]
Maxillaria friedrichsthalii **Rchb.** [GN]
Maxillaria fulgens **(Rchb.) L.O. Williams** [GN]
Maxillaria hedwigiae **Hamer & Dodson** [BU]
Maxillaria parviflora **(Poepp. & Endl.) Garay** [GN]
Maxillaria pulchra **(Schltr.) L.O. Williams** [GD]
Maxillaria tenuifolia **Lindl.** [BU]
Maxillaria uncata **Lindl.** [GN]
Maxillaria variabilis **Bateman ex Lindl.** [GN]
Maxillariella tenuifolia **(Lindl.) M.A. Blanco & Carnevali** [GN]
Mesadenella petenensis **(L.O. Williams) Garay** [GD]
Mormolyca ringens **(Lindl.) Schltr.** [BU]
Myoxanthus octomerioides **(Lindl.) Luer** [GD]
Myrmecophila brysiana **(Lem.) G.C. Kenn.** [BU]
Myrmecophila christinae **Carnevali & Gómez Juarez** [GD]
Myrmecophila tibicinis **(Bateman ex Lindl.) Rolfe** [BU]
Nidema boothii **(Lindl.) Schltr.** [GN]
Oerstedella verrucosa **(Sw.) Hágsater** [BU]
Oestlundia distantiflora **(A. Rich. & Galeotti) W.E. Higgins** [BK]
Oncidium cheirophorum **Rchb. f.** [BU]
Oncidium ensatum **Lindl.** [BU]
Oncidium sphacelatum **Lindl.** [GN]
Oncidium subcruciforme **(Heller) Garay & Stacy** [GD]
Ornithocephalus bicornis **Lindl.** [GN]
Ornithocephalus gladiatus **Hook.** [GN]
Panmorphia sertularioides **(Sw.) Luer** [GD]
Pelexia adnata **(Sw.) Spreng.** [GN]
Pelexia funckiana **(A. Rich. & Galeotti) Schltdl.** [GD]
Pelexia laxa **(Poepp. & Endl.) Lindl.** [GN]
Pelexia olivacea **Rolfe** [GN]
Platystele minimiflora **(Schltr.) Garay** [BU]
Platystele ovatilabia **(Ames & C. Schweinf.) Garay** [GD]
Platystele repens **(Ames) Garay** [BK]
Platystele stenostachya **(Rchb. f.) Garay** [GN]
Platythelys maculata **(Hook.) Garay** [GN]
Platythelys querceticola **(Lindl.) Garay** [GD]
Platythelys vaginata **(Hook.) Garay** [BU]
Pleurothallis brighamii **S. Watson** [BU]
Pleurothallis cardiothallis **Rchb.** [BU]
Pleurothallis deregularis **(Barb. Rodr.) Luer** [BU]
Pleurothallis erinacea **Rchb.** [GN]
Pleurothallis gelida **Lindl.** [GN]
Pleurothallis grobyi **Bateman ex Lindl.** [GN]
Pleurothallis homalantha **Schltr.** [BU]
Pleurothallis microphylla **A. Rich. & Galeotti** [GN]
Pleurothallis pansamalae **Schltr.** [GD]
Pleurothallis sertularioides **(Sw.) Spreng.** [BU]
Pleurothallis uncinata **Fawc.** [GD]
Polystachya foliosa **(Hook.) Rchb. f.** [GN]
Polystachya masayensis **Rchb.** [GN]
Ponera striata **Lindl.** [GN]
Prescottia stachyodes **(Sw.) Lindl.** [GN]
Prosthechea baculus **(Rchb.) W.E. Higgins** [BU]
Prosthechea boothiana **(Lindl.) W.E. Higgins** [GD]
Prosthechea chacaoensis **(Rchb.) W.E. Higgins** [BU]
Prosthechea cochleata **(L.) W.E. Higgins** [GN]
Prosthechea neurosa **(Ames) W.E. Higgins** [GD]

***Prosthechea pygmaea* (Hook.) W.E. Higgins** [GN]
***Prosthechea vespa* (Vell.) W.E. Higgins** [GN]
***Pseudogoodyera wrightii* (Rchb.) Schltr.** [GD]
***Psilochilus macrophyllus* (Lindl.) Ames** [GN]
***Psygmorchis pusilla* (L.) Dodson & Dressler** [GN]
***Restrepiella ophiocephala* (Lindl.) Garay & Dunst.** [GD]
***Rhyncholaelia digbyana* (Lindl.) Schltr.** [GD]
***Sacoila lanceolata* (Aubl.) Garay** [GN]
***Sarcoglottis sceptrodes* (Rchb.) Schltr.** [GN]
***Scaphyglottis behrii* (Rchb. f.) Benth. & Hook.f. ex Hemsl.** [GN]
***Scaphyglottis confusa* (Schltr.) Ames & Correll** [BU]
***Scaphyglottis fasciculata* Hook.** [BU]
***Scaphyglottis leucantha* Rchb. f.** [GN]
***Scaphyglottis lindeniana* (A. Rich. & Galeotti) L.O. Williams** [GN]
***Scaphyglottis longicaulis* S. Watson** [GN]
***Scaphyglottis minutiflora* Ames & Correll** [GN]
***Scaphyglottis prolifera* Cogn.(Sw.)** [GN]
***Sobralia decora* Bateman** [GN]
***Sobralia fragrans* Lindl.** [GN]
***Sobralia macrantha* Lindl.** [GN]
***Sobralia mucronata* Ames & C. Schweinf.** [BU]
***Sobralia warszewiczii* Rchb. f.** [GD]
***Specklinia yucatanensis* (Ames & C. Schweinf.) Pridgeon & Chase** [GD]
***Spiranthes graminea* Lindl.** [GD]
***Spiranthes torta* (Thunb.) Garay & H.R. Sweet** [BU]
***Stelis ciliaris* Lindl.** [GN]
***Stelis gracilis* Ames** [GD]
***Stelis johnsonii* Ames** [BK]
***Stenorrhynchos aurantiacum* (La Llave & Lex.) Lindl.** [BU]
***Trichocentrum ascendens* (Lindl.) M.W. Chase & N.H. Williams** [GN]
***Trichocentrum carthagenense* (Jacq.) M.W. Chase & N.H. Williams** [GN]
***Trichocentrum undulatum* (Sw.) Ackerman & M.W. Chase** [GD]
***Trichosalpinx blaisdellii* (S. Watson) Luer** [GN]
***Trichosalpinx ciliaris* (Lindl.) Luer** [GN]
***Trigonidium egertonianum* Bateman ex Lindl.** [GN]
***Vanilla cribbiana* Soto Arenas** [BK]
***Vanilla hartii* Rolfe** [GN]
***Vanilla inodora* Schiede** [GD]
***Vanilla insignis* Ames** [GD]
***Vanilla odorata* C. Presl** [GN]
***Vanilla planifolia* Andrews** [GN]
***Xylobium colleyi* (Bateman ex Lindl.) Rolfe** [GN]

OROBANCHACEAE
***Agalinis harperi* Pennell ex Small** [GD]
***Agalinis hispidula* (Mart.) D'Arcy** [GN]
***Agalinis maritima* (Raf.) Raf.** [GD]
***Anisantherina hispidula* (Mart.) Pennell** [GN]
***Buchnera floridana* Gand.** [BU]
***Buchnera obliqua* Benth.** [BU]
***Buchnera palustris* (Aubl.) Spreng.** [GN]
***Buchnera pusilla* Kunth** [GN]
***Escobedia laevis* Schltdl. & Cham.** [GD]

OXALIDACEAE
***Biophytum dendroides* (Kunth) DC.** [GN]
***Oxalis corniculata* L.** [GN]
***Oxalis frutescens* L.** [GN]
***Oxalis frutescens* L. subsp. *angustifolia* (Kunth) Lourteig** [GN]
***Oxalis latifolia* Kunth** [GN]

PAPAVERACEAE
***Argemone mexicana* L.** [GN]
***Bocconia frutescens* L.** [GN]

PASSIFLORACEAE
Passiflora adenopoda **DC.** [GN]
Passiflora ambigua **Hemsl.** [GN]
Passiflora biflora **Lam.** [GN]
Passiflora capsularis **L.** [GN]
Passiflora ciliata **Aiton** [GN]
Passiflora cobanensis **Killip** [GD]
Passiflora coriacea **Juss.** [GN]
Passiflora costaricensis **Killip** [GN]
Passiflora foetida **L.** [GN]
Passiflora foetida **L. var. *gossypiifolia* (Desv. ex Ham.) Mast.** [GN]
Passiflora guatemalensis **S. Watson** [GN]
Passiflora hahnii **(E. Fourn.) Mast.** [GN]
Passiflora helleri **Peyr** [GN]
Passiflora lancetillensis **J.M. MacDougal & Meerman** [GD]
Passiflora mayarum **J.M. MacDougal** [GD]
Passiflora obovata **Killip** [GD]
Passiflora pallida **L.** [GN]
Passiflora pittieri **Mast.** [GN]
Passiflora prolata **Mast.** [GD]
Passiflora rovirosae **Killip** [BU]
Passiflora serratifolia **L.** [GN]
Passiflora sexflora **Juss.** [GN]
Passiflora sexocellata **Schltdl.** [BU]
Passiflora suberosa **L.** [GN]
Passiflora urbaniana **Killip** [BK]
Passiflora xiikzodz **J.M. MacDougal** [GD]
Passiflora xiikzodz **J.M. MacDougal subsp. *xiikzodz*** [BK]

PEDALIACEAE
Sesamum indicum **L.** [GN]

PENTAPHYLACACEAE
Freziera grisebachii **Krug & Urb.** [BU]
Symplococarpon purpusii **(Brandegee) Kobuski** [BU]
Ternstroemia oocarpa **(Rose) Melch.** [GD]
Ternstroemia sylvatica **Schltdl. & Cham.** [GD]
Ternstroemia tepezapote **Schltdl. & Cham.** [BU]

PHYLLANTHACEAE
Amanoa guianensis **Aubl.** [GN]
Astrocasia tremula **(Griseb.) G.L.Webster** [BU]
Breynia disticha **J.R.Forst. & G.Forst.** [GN]
Margaritaria nobilis **L. f.** [GN]
Meineckia bartlettii **(Standl.) G.L.Webster** [GD]
Phyllanthus acidus **(L.) Skeels** [GN]
Phyllanthus acuminatus **Vahl** [GN]
Phyllanthus amarus **Schumach. & Thonn.** [GN]
Phyllanthus brasiliensis **(Aubl.) Poir.** [GN]
Phyllanthus compressus **Kunth** [GN]
Phyllanthus elsiae **Urb.** [GN]
Phyllanthus grandifolius **L.** [GN]
Phyllanthus liebmannianus **Müll.Arg.** [GD]
Phyllanthus liebmannianus **Müll.Arg. subsp. *liebmannianus*** [GD]
Phyllanthus mocinianus **Baill.** [GN]
Phyllanthus niruri **L.** [GN]
Phyllanthus stipulatus **(Raf.) G.L.Webster** [GN]

PHYTOLACCACEAE
Microtea debilis **Sw.** [GN]
Petiveria alliacea **L.** [GN]
Petiveria alliacea **L. var. *alliacea*** [GN]
Phytolacca icosandra **L.** [GN]
Phytolacca rivinoides **Kunth & C. D. Bouché** [GN]
Phytolacca thyrsiflora **Fenzl ex J.A. Schmidt** [GN]

***Rivina humilis* L.** [GN]
***Trichostigma octandrum* (L.) H. Walter** [GN]

PICRAMNIACEAE
***Alvaradoa amorphoides* Liebm.** [GN]
Alvaradoa amorphoides* Liebm. subsp. *amorphoides [BU]
***Picramnia antidesma* Sw.** [GN]
Picramnia antidesma* Sw. subsp. *antidesma [GN]
***Picramnia antidesma* Sw. subsp. *fessonia* (DC.) W.W. Thomas** [GN]

PINACEAE
***Pinus caribaea* Morelet** [GN]
Pinus caribaea* Morelet var. *caribaea [GN]
***Pinus caribaea* Morelet var. *hondurensis* (Sénécl.) W.H.G. Barrett & Golfari** [GN]
***Pinus oocarpa* Schiede ex Schltdl.** [GN]
***Pinus tecunumanii* Eguiluz & Perry** [BU]

PIPERACEAE
***Peperomia alata* Ruiz & Pav.** [GN]
***Peperomia angustata* Kunth** [GN]
***Peperomia claytonioides* Kunth** [BU]
***Peperomia cyclophylla* Miq.** [GN]
***Peperomia deppeana* Schltdl. & Cham.** [GN]
***Peperomia emarginella* (Sw. ex Wikstr.) C. DC.** [GN]
***Peperomia emiliana* C. DC.** [BU]
***Peperomia glabella* (Sw.) A. Dietr.** [GN]
***Peperomia griggsii* C. DC.** [GD]
***Peperomia hirta* C. DC.** [BU]
***Peperomia hoffmannii* C. DC.** [BU]
***Peperomia macrostachya* (Vahl) A. Dietr.** [GN]
***Peperomia maculosa* (L.) Hook.** [GN]
***Peperomia magnoliifolia* (Jacq.) A. Dietr.** [GN]
***Peperomia matlalucaensis* C. DC.** [BU]
***Peperomia obtusifolia* (L.) A. Dietr.** [GN]
***Peperomia pellucida* (L.) Kunth** [GN]
***Peperomia petrophila* C. DC.** [GN]
***Peperomia portobellensis* Beurl.** [BU]
***Peperomia pseudopereskiifolia* C. DC.** [GN]
***Peperomia rhombea* Ruiz & Pav.** [GN]
***Peperomia rotundifolia* (L.) Kunth** [GN]
Peperomia rotundifolia* (L.) Dahlst. var. *rotundifolia [GN]
***Peperomia san-felipensis* C. DC. ex Donn. Sm.** [BU]
***Peperomia serpens* (Sw.) Loudon** [GN]
***Peperomia silvivaga* C. DC.** [BU]
***Peperomia syringifolia* C. DC.** [BU]
***Peperomia tetraphylla* (G.Forst.) Hook. & Arn.** [GN]
***Peperomia tuisana* C. DC.** [BU]
***Peperomia urocarpa* (Miq.) Fisch. & C.A.Mey.** [GN]
***Peperomia versicolor* Trel.** [BU]
***Piper aduncum* L.** [GN]
***Piper aequale* Vahl** [GN]
***Piper amalago* L.** [GN]
***Piper arboreum* Aubl.** [GN]
***Piper auritum* Kunth** [GN]
***Piper dilatatum* Rich.** [GN]
***Piper glabrescens* (Miq.) C. DC.** [GN]
***Piper grande* Vahl** [GN]
***Piper hispidum* Sw.** [GN]
***Piper jacquemontianum* Kunth** [BU]
***Piper kantetulense* Trel.** [BK]
***Piper marginatum* Jacq.** [GN]
***Piper neesianum* C. DC.** [BU]
***Piper obliquum* Ruiz & Pav.** [GN]
***Piper patulum* Bertol.** [GD]
***Piper peltatum* L.** [GN]

***Piper pseudoasperifolium* C. DC.** [GD]
***Piper pseudofuligineum* C. DC.** [GN]
***Piper pseudolindenii* C. DC.** [GN]
***Piper psilorhachis* C. DC.** [GD]
***Piper sanctif-elicis* Trel.** [GN]
***Piper sanctum* (Miq.) Schltdl. ex C. DC.** [BU]
***Piper schiedeanum* Steud.** [GN]
***Piper schippianum* Trel. & Standl.** [BK]
***Piper stevensii* Trel.** [GD]
***Piper tuberculatum* Jacq.** [GN]
***Piper tuerckheimii* C. DC.** [GD]
***Piper umbellatum* L.** [GN]
***Piper urophyllum* C. DC.** [GN]
***Piper villiramulum* C. DC.** [GN]
***Piper yucatanense* C. DC.** [BU]
***Piper zacatense* C. DC.** [GD]

PLANTAGINACEAE
***Angelonia ciliaris* B.L.Rob.** [GD]
***Bacopa bacopoides* (Benth.) Pulle** [GD]
***Bacopa lacertosa* Standl.** [GD]
***Bacopa monnieri* (L.) Wettst.** [GN]
***Bacopa repens* (Sw.) Wettst.** [GN]
***Bacopa sessiliflora* (Benth.) Edwall** [GN]
***Benjaminia reflexa* (Benth.) D'Arcy** [GN]
***Mecardonia procumbens* (Mill.) Small** [GN]
***Plantago major* L.** [GN]
***Russelia campechiana* Standl.** [GD]
***Russelia equisetiformis* Schltdl. & Cham.** [GN]
***Russelia parvifolia* Carlson** [GD]
***Russelia sarmentosa* Jacq.** [GN]
***Russelia sonorensis* Carlson** [GD]
***Scoparia dulcis* L.** [GN]
***Stemodia durantifolia* (L.) Sw.** [GN]
***Stemodia fruticosa* Lundell** [GD]
***Stemodia maritima* L.** [GN]
***Stemodia peduncularis* Benth.** [GD]
***Stemodia verticillata* (Mill.) Hassl.** [GN]
***Tetranema roseum* (M. Martens & Galeotti) Standl. & Steyerm.** [GN]

PLUMBAGINACEAE
***Plumbago zeylanica* L.** [GN]

POACEAE
***Acroceras zizanioides* (Kunth) Dandy** [GN]
***Andropogon bicornis* L.** [GN]
***Andropogon bourgaei* Hack.** [GD]
***Andropogon gerardi* Vitman var. *hondurensis* R.W. Pohl** [GD]
***Andropogon glomeratus* (Walter) Britton, Sterns & Poggenb.** [GN]
***Andropogon leucostachyus* Kunth** [GN]
***Andropogon selloanus* (Hack.) Hack.** [GN]
***Andropogon virgatus* Desv. ex Ham.** [GN]
***Andropogon virginicus* L.** [GN]
***Anthephora hermaphrodita* (L.) Kuntze** [GN]
***Aristida appressa* Vasey** [BU]
***Aristida capillacea* Lam.** [GN]
***Aristida gibbosa* (Nees) Kunth** [GN]
***Aristida hamulosa* Henrard** [GD]
***Aristida megapotamica* Spreng.** [GN]
***Aristida purpurascens* Poir. var. *tenuispica* (Hitchc.) Allred** [GD]
***Aristida recurvata* Kunth** [GN]
***Aristida setifolia* Kunth** [GN]
***Arundinella berteroniana* (Schult.) Hitchc. & Chase** [GN]
***Arundinella deppeana* Nees ex Steud.** [GN]
***Axonopus aureus* P. Beauv.** [GN]

***Axonopus capillaris* (Lam.) Chase** [GN]
***Axonopus ciliatifolius* Swallen** [BK]
***Axonopus compressus* (Sw.) P. Beauv.** [GN]
***Axonopus fissifolius* (Raddi) Kuhlm.** [GN]
***Axonopus poiophyllus* Chase** [GN]
***Axonopus purpusii* (Mez) Chase** [GN]
***Bambusa vulgaris* Schrad. ex J.C. Wendl.** [GN]
***Bothriochloa bladhii* (Retz.) S.T. Blake** [GN]
***Bothriochloa pertusa* (L.) A. Camus** [GN]
***Cenchrus brownii* Roem. & Schult.** [GN]
***Cenchrus echinatus* L.** [GN]
***Cenchrus incertus* M.A. Curtis** [GN]
***Chloris barbata* Sw.** [GN]
***Chloris ciliata* Sw.** [GN]
***Chloris radiata* (L.) Sw.** [GN]
***Cryptochloa strictiflora* (E.Fourn.) Swallen** [BU]
***Cymbopogon citratus* (DC.) Stapf** [GN]
***Cynodon dactylon* (L.) Pers.** [GN]
***Cynodon nlemfuensis* Vanderyst** [GN]
***Dactyloctenium aegyptium* (L.) Willd.** [GN]
***Dichanthelium aciculare* (Desv. ex Poir.) Gould & C.A. Clark** [GN]
***Dichanthelium acuminatum* (Sw.) Gould & C.A. Clark** [GN]
Dichanthelium acuminatum* (Sw.) Gould & C.A. Clark var. *acuminatum [GN]
***Dichanthelium acuminatum* (Sw.) Gould & C.A. Clark var. *longiligulatum* (Nash) Gould & C.A. Clark** [GN]
***Dichanthelium dichotomum* (L.) Gould** [BU]
***Dichanthelium ensifolium* (Baldwin ex Elliott) Gould** [GD]
***Dichanthelium portoricense* (Desv. ex Ham.) B.F. Hansen & Wunderlin** [GD]
***Dichanthelium sciurotoides* (Zuloaga & Morrone) Davidse** [GN]
***Dichanthelium sphaerocarpon* (Elliott) Gould** [GN]
***Dichanthelium sphaerocarpon* (Elliot) Gould var. *floridanum* (Vasey) Davidse** [GN]
***Dichanthelium strigosum* (Muhl. ex Elliott) Freckmann** [GN]
Dichanthelium strigosum* (Muhl. ex Elliott) Freckmann var. *strigosum [GN]
***Dichanthelium viscidellum* (Scribn.) Gould** [GN]
***Dichanthium annulatum* (Forssk.) Stapf** [GN]
***Digitaria bicornis* (Lam.) Roem. & Schult.** [GN]
***Digitaria cayoensis* Swallen** [GD]
***Digitaria ciliaris* (Retz.) Koeler** [GN]
***Digitaria fuscescens* (J. Presl) Henrard** [GN]
***Digitaria horizontalis* Willd.** [GN]
***Digitaria insularis* (L.) Fedde** [GN]
***Digitaria multiflora* Swallen** [GD]
***Digitaria setigera* Roth** [GN]
***Distichlis spicata* (L.) Greene** [GN]
***Echinochloa colona* (L.) Link** [GN]
***Echinochloa crus-pavonis* (Kunth) Schult.** [GN]
***Echinochloa polystachya* (Kunth) Hitchc.** [GN]
Echinochloa polystachya* (Kunth) Hitchc. var. *polystachya [GN]
***Echinolaena gracilis* Swallen** [GN]
***Echinolaena standleyi* (Hitchc.) Stieber** [GD]
***Eleusine indica* (L.) Gaertn.** [GN]
***Eragrostis acutiflora* (Kunth) Nees** [GN]
***Eragrostis atrovirens* (Desf.) Trin. ex Steud.** [GN]
***Eragrostis bahiensis* Schrad. ex Schult.** [GN]
***Eragrostis ciliaris* (L.) R. Br.** [GN]
***Eragrostis contrerasii* R.W. Pohl** [GD]
***Eragrostis elliottii* S. Watson** [BU]
***Eragrostis excelsa* Griseb.** [GD]
***Eragrostis gangetica* (Roxb.) Steud.** [GN]
***Eragrostis hypnoides* (Lam.) Britton, Sterns & Poggenb.** [GN]
***Eragrostis maypurensis* (Kunth) Steud.** [GN]
***Eragrostis mexicana* (Hornem.) Link** [GN]
***Eragrostis prolifera* (Sw.) Steud.** [GN]
***Eragrostis rufescens* Schrad. ex Schult. var. *mesoamericana* Davidse** [GN]
***Eragrostis unioloides* (Retz.) Nees ex Steud.** [GN]
***Eriochloa punctata* (L.) Desv.** [GN]

***Eriochrysis cayennensis* P. Beauv.** [GN]
***Eustachys petraea* (Sw.) Desv.** [GN]
***Guadua longifolia* (E.Fourn.) R.W. Pohl** [GD]
***Gymnopogon spicatus* (Spreng.) Kuntze** [GN]
***Gynerium sagittatum* (Aubl.) P. Beauv.** [GN]
***Hackelochloa granularis* (L.) Kuntze** [GN]
***Homolepis aturensis* (Kunth) Chase** [GN]
***Hymenachne amplexicaulis* (Rudge) Nees** [GN]
***Hyparrhenia rufa* (Nees) Stapf** [GN]
***Hypogynium virgatum* (Desv. ex Ham.) Dandy** [GN]
***Ichnanthus calvescens* (Nees ex Trin.) Döll var. *scabrior* Döll** [GN]
***Ichnanthus dasycoleus* Tutin** [GN]
***Ichnanthus lanceolatus* Scribn. & J.G.Sm.** [GD]
***Ichnanthus mexicanus* E.Fourn.** [BK]
***Ichnanthus nemoralis* (Schrad.) Hitchc. & Chase** [GN]
***Ichnanthus nemorosus* (Sw.) Döll** [GN]
***Ichnanthus pallens* (Sw.) Munro ex Benth.** [GN]
***Ichnanthus tenuis* (J. Presl) Hitchc. & Chase** [GN]
***Imperata brasiliensis* Trin.** [GN]
***Isachne polygonoides* (Lam.) Döll** [GN]
***Isachne pubescens* Swallen** [GD]
***Ischaemum latifolium* (Spreng.) Kunth** [GN]
***Ixophorus unisetus* (J. Presl) Schltdl.** [GN]
***Lasiacis divaricata* (L.) Hitchc.** [GN]
Lasiacis divaricata* (L.) Hitchc. var. *divaricata [GN]
***Lasiacis divaricata* (L.) Hitchc. var. *leptostachya* (Hitchc.) Davidse** [GN]
***Lasiacis grisebachii* (Nash) Hitchc.** [BU]
Lasiacis grisebachii* (Nash) Hitchc. var. *grisebachii [BU]
***Lasiacis nigra* Davidse** [GN]
***Lasiacis oaxacensis* (Steud.) Hitchc.** [GN]
Lasiacis oaxacensis* (Steud.) Hitchc. var. *oaxacensis [GN]
***Lasiacis procerrima* (Hack.) Hitchc.** [GN]
***Lasiacis rugelii* (Griseb.) Hitchc.** [GN]
Lasiacis rugelii* (Griseb.) Hitchc. var. *rugelii [BU]
***Lasiacis ruscifolia* (Kunth) Hitchc.** [GN]
Lasiacis ruscifolia* (Kunth) Hitchc. var. *ruscifolia [GN]
***Lasiacis scabrior* Hitchc.** [GN]
***Lasiacis sloanei* (Griseb.) Hitchc.** [GN]
***Lasiacis standleyi* Hitchc.** [GN]
***Leersia hexandra* Sw.** [GN]
***Leersia ligularis* Trin. var. *breviligulata* (Prodoehl) Pyrah** [BU]
***Leptochloa virgata* (L.) P. Beauv.** [GN]
***Leptocoryphium lanatum* (Kunth) Nees** [GN]
***Lithachne pauciflora* (Sw.) P. Beauv.** [GN]
***Melinis minutiflora* P. Beauv.** [GN]
***Merostachys latifolia* R.W. Pohl** [GD]
***Mesosetum blakei* Swallen** [GD]
***Mesosetum filifolium* F.T. Hubb.** [GN]
***Muhlenbergia tenella* (Kunth) Trin.** [GN]
***Ocellochloa stolonifera* (Poir.) Zuloaga & Morrone** [GN]
***Olyra glaberrima* Raddi** [GN]
***Olyra latifolia* L.** [GN]
***Oplismenus burmannii* (Retz.) P. Beauv. var. *nudicaulis* (Vasey) McVaugh** [GN]
***Oplismenus hirtellus* (L.) P. Beauv.** [GN]
Oplismenus hirtellus* (L.) P. Beauv. subsp. *hirtellus [GN]
***Oplismenus hirtellus* (L.) P. Beauv. subsp. *setarius* (Lam.) Mez ex Ekman** [GN]
***Oryza latifolia* Desv.** [GN]
***Oryza rufipogon* Griff.** [GN]
***Oryza sativa* L.** [GN]
***Panicum altum* Hitchc. & Chase** [GN]
***Panicum amarum* Elliott var. *amarulum* (Hitchc. & Chase) P. Palmer** [GD]
***Panicum aquaticum* Poir.** [GN]
***Panicum bartlettii* Swallen** [BU]
***Panicum caricoides* Nees ex Trin.** [GN]
***Panicum cayennense* Lam.** [GN]

***Panicum cayoense* Swallen** [GD]
***Panicum cyanescens* Nees ex Trin.** [GN]
***Panicum discrepans* Döll** [GN]
***Panicum elephantipes* Nees ex Trin.** [GN]
***Panicum ghiesbreghtii* E.Fourn.** [GN]
***Panicum haenkeanum* J. Presl** [GN]
***Panicum hirsutum* Sw.** [GN]
***Panicum hirtum* Lam.** [GN]
***Panicum hylaeicum* Mez** [GN]
***Panicum laxum* Sw.** [GN]
***Panicum maximum* Jacq.** [GN]
Panicum maximum* Jacq. var. *maximum [GN]
***Panicum parvifolium* Lam.** [GN]
***Panicum pilosum* Sw.** [GN]
Panicum pilosum* Sw. var. *pilosum [GN]
***Panicum pulchellum* Raddi** [GN]
***Panicum repens* L.** [GN]
***Panicum rudgei* Roem. & Schult.** [GN]
***Panicum sellowii* Nees** [GN]
***Panicum stagnatile* Hitchc. & Chase** [BU]
***Panicum stenodes* Griseb.** [GN]
***Panicum tenerum* Beyr. ex Trin.** [GD]
***Panicum trichanthum* Nees** [GN]
***Panicum trichidiachne* Düll** [GN]
***Panicum trichoides* Sw.** [GN]
***Panicum tuerckheimii* Hack.** [GD]
***Panicum virgatum* L.** [GN]
***Paspalidium geminatum* (Forssk.) Stapf** [GN]
***Paspalum arundinaceum* Poir.** [GN]
***Paspalum blodgettii* Chapm.** [GN]
***Paspalum caespitosum* Flüggé** [GN]
***Paspalum clavuliferum* C. Wright** [GN]
***Paspalum conjugatum* P.J. Bergius** [GN]
***Paspalum convexum* Humb. & Bonpl. ex Flüggé** [GN]
***Paspalum corcovadense* Raddi** [GN]
***Paspalum coryphaeum* Trin.** [GN]
***Paspalum decumbens* Sw.** [GN]
***Paspalum fasciculatum* Willd. ex Flüggé** [GN]
***Paspalum fimbriatum* Kunth** [GN]
***Paspalum langei* (E.Fourn.) Nash** [GN]
***Paspalum laxum* Lam.** [GN]
***Paspalum ligulare* Nees** [GN]
***Paspalum lineare* Trin.** [GN]
***Paspalum microstachyum* J. Presl** [GN]
***Paspalum millegrana* Schrad.** [GN]
***Paspalum minus* E.Fourn.** [GN]
***Paspalum multicaule* Poir.** [GN]
***Paspalum notatum* Flüggé** [GN]
***Paspalum nutans* Lam.** [GN]
***Paspalum orbiculatum* Poir.** [GN]
***Paspalum paniculatum* L.** [GN]
***Paspalum peckii* F.T. Hubb.** [BK]
***Paspalum pectinatum* Nees ex Trin.** [GN]
***Paspalum pilosum* Lam.** [GN]
***Paspalum plicatulum* Michx.** [GN]
***Paspalum pulchellum* Kunth** [GN]
***Paspalum serpentinum* Hochst. ex Steud.** [GN]
***Paspalum setaceum* Michx.** [GN]
***Paspalum urvillei* Steud.** [GN]
***Paspalum vaginatum* Sw.** [GN]
***Paspalum virgatum* L.** [GN]
***Paspalum wrightii* Hitchc. & Chase** [GN]
***Pennisetum purpureum* Schumach.** [GN]
***Pennisetum setosum* (Sw.) Rich.** [GN]
***Pentarrhaphis scabra* Kunth** [BU]

***Pharus latifolius* L.** [GN]
***Pharus parvifolius* Nash** [GN]
***Pharus parvifolius* Nash subsp. *elongatus* Judz.** [GN]
***Pharus vittatus* Lem.** [BU]
***Phragmites australis* (Cav.) Trin. ex Steud.** [GN]
***Rhipidocladum bartlettii* (McClure) McClure** [BU]
***Rhynchelytrum repens* (Willd.) C.E. Hubb.** [GN]
***Rottboellia cochinchinensis* (Lour.) Clayton** [GN]
***Rugoloa pilosa* (Sw.) Zuloaga** [GN]
***Rugoloa polygonata* (Schrad.) Zuloaga** [GN]
***Saccharum officinarum* L.** [GN]
***Sacciolepis myuros* (Lam.) Chase** [GN]
***Schizachyrium brevifolium* (Sw.) Nees ex Büse** [GN]
***Schizachyrium microstachyum* (Desv. ex Ham.) Roseng., B.R. Arrill. & Izag.** [GN]
***Schizachyrium sanguineum* (Retz.) Alston** [GN]
***Schizachyrium tenerum* Nees** [GN]
***Setaria grisebachii* E.Fourn.** [GN]
***Setaria parviflora* (Poir.) Kerguélen** [GN]
***Setaria poiretiana* (Schult.) Kunth** [GN]
***Setaria tenacissima* Schrad. ex Schult.** [GN]
***Setaria tenax* (Rich.) Desv.** [GN]
***Setaria vulpiseta* (Lam.) Roem. & Schult.** [GN]
***Sorghastrum setosum* (Griseb.) Hitchc.** [GN]
***Sorghum bicolor* (L.) Moench** [GN]
***Sorghum halepense* (L.) Pers.** [GN]
***Spartina patens* (Aiton) Muhl.** [GN]
***Spartina spartinae* (Trin.) Merr. ex Hitchc.** [GN]
***Sporobolus buckleyi* Vasey** [GN]
***Sporobolus cubensis* Hitchc.** [GN]
***Sporobolus diandrus* (Retz.) P. Beauv.** [GN]
***Sporobolus indicus* (L.) R. Br.** [GN]
***Sporobolus jacquemontii* Kunth** [GN]
***Sporobolus purpurascens* (Sw.) Ham.** [BU]
***Sporobolus tenuissimus* (Schrank) Kuntze** [GN]
***Sporobolus virginicus* (L.) Kunth** [GN]
***Steinchisma laxum* (Sw.) Zuloaga** [GN]
***Stenotaphrum secundatum* (Walter) Kuntze** [GN]
***Streptochaeta sodiroana* Hack.** [BU]
***Streptogyna americana* C.E. Hubb.** [GN]
***Thrasya campylostachya* (Hack.) Chase** [GN]
***Thrasya trinitensis* Mez** [GN]
***Trachypogon spicatus* (L. f.) Kuntze** [GN]
***Tripsacum andersonii* J.R. Gray** [GN]
***Tripsacum dactyloides* (L.) L. var. *mexicanum* de Wet & J.R. Harlan** [GN]
***Tripsacum latifolium* Hitchc.** [BU]
***Uniola pittieri* Hack.** [BU]
***Urochloa fusca* (Sw.) B.F. Hansen & Wunderlin** [GN]
***Urochloa mutica* (Forssk.) T.Q. Nguyen** [GN]
***Urochloa reptans* (L.) Stapf** [GN]
***Vetiveria zizanioides* (L.) Nash** [GN]
***Zea mays* L.** [GN]
***Zoysia matrella* (L.) Merr.** [GN]

PODOCARPACEAE
***Podocarpus guatemalensis* Standl.** [GN]

PODOSTEMACEAE
***Marathrum foeniculaceum* Humb. & Bonpl.** [GN]
***Podostemum rutifolium* subsp. *ricciiforme* (Liebm.) Novelo & C. Philbrick** [BU]
***Tristicha trifaria* (Bory ex Willd.) Spreng.** [GN]

POLEMONIACEAE
***Loeselia glandulosa* (Cav.) G. Don** [GN]

POLYGALACEAE

***Bredemeyera lucida* (Benth.) Klotzsch ex Hassk.** [GN]
***Polygala adenophora* DC.** [GN]
***Polygala aparinoides* Hook. & Arn.** [GN]
***Polygala asperuloides* Kunth** [GN]
***Polygala glochidiata* Kunth** [GN]
***Polygala hondurana* Chodat** [BU]
***Polygala hygrophila* Kunth** [GN]
***Polygala incarnata* L.** [GN]
***Polygala jamaicensis* Chodat** [GD]
***Polygala leptocaulis* Torr. & A. Gray** [GN]
***Polygala longicaulis* Kunth** [GN]
***Polygala paniculata* L.** [GN]
***Polygala tenella* Willd.** [GN]
***Polygala trichosperma* L.** [GN]
***Polygala variabilis* Kunth** [GN]
***Polygala violacea* Aubl.** [GN]
***Securidaca diversifolia* (L.) S.F. Blake** [GN]
***Securidaca sylvestris* Schltdl.** [GN]

POLYGONACEAE
***Antigonon leptopus* Hook. & Arn.** [GN]
***Coccoloba acapulcensis* Standl.** [BU]
***Coccoloba barbadensis* Jacq.** [BU]
***Coccoloba belizensis* Standl.** [BU]
***Coccoloba cozumelensis* Hemsl.** [BU]
***Coccoloba diversifolia* Jacq.** [BU]
***Coccoloba hirtella* Lundell** [GD]
***Coccoloba hondurensis* Lundell** [GD]
***Coccoloba humboldtii* Meisn.** [GD]
***Coccoloba reflexiflora* Standl.** [GD]
***Coccoloba spicata* Lundell** [GD]
***Coccoloba swartzii* Meisn.** [BU]
***Coccoloba tuerckheimii* Donn. Sm.** [BU]
***Coccoloba uvifera* (L.) L.** [GN]
***Gymnopodium floribundum* Rolfe** [GD]
***Neomillspaughia emarginata* (Gross) S.F.Blake** [GD]
***Neomillspaughia paniculata* (Donn. Sm.) S.F. Blake** [GD]
***Persicaria punctata* (Elliott) Small** [GN]
***Polygonum acuminatum* Kunth** [GN]
***Polygonum persicarioides* Kunth** [BU]
***Polygonum punctatum* Elliott** [GN]
***Polygonum segetum* Kunth** [GN]

POLYPODIACEAE
***Campyloneurum angustifolium* (Sw.) Fée** [GN]
***Campyloneurum brevifolium* (Lodd. ex Link) Link** [GN]
***Campyloneurum costatum* (Kunze) C. Presl** [GN]
***Campyloneurum fasciale* (Humb. & Bonpl. ex Willd.) C. Presl** [GN]
***Campyloneurum phyllitidis* (L.) C. Presl** [GN]
***Campyloneurum repens* (Aubl.) C. Presl** [GN]
***Cochlidium linearifolium* (Desv.) Maxon ex C. Chr.** [GN]
***Cochlidium serrulatum* (Sw.) L.E. Bishop** [GN]
***Microgramma lycopodioides* (L.) Copel.** [GN]
***Microgramma nitida* (J.Sm.) A.R.Sm.** [BU]
***Microgramma percussa* (Cav.) de la Sota** [GN]
***Microgramma reptans* (Cav.) A.R.Sm.** [GN]
***Microgramma squamulosa* (Kaulf.) de la Sota** [GN]
***Micropolypodium taenifolium* (Jenman) A.R.Sm.** [GN]
***Neurodium lanceolatum* (L.) Fée** [BU]
***Niphidium crassifolium* (L.) Lellinger** [GN]
***Niphidium oblanceolatum* A. Rojas** [BU]
***Pecluma alfredii* (Rosenst.) M.G. Price** [BU]
***Pecluma atra* (A.M. Evans) M.G. Price** [BU]
***Pecluma dispersa* (A.M. Evans) M.G. Price** [GN]
***Pecluma divaricata* (E.Fourn.) Mickel & Beitel** [GN]

***Pecluma pectinata* (L.) M.G. Price** [GN]
***Pecluma plumula* (Humb. & Bonpl. ex Willd.) M.G. Price** [GN]
***Phlebodium decumanum* (Willd.) J.Sm.** [GN]
***Pleopeltis astrolepis* (Liebm.) E.Fourn.** [GN]
***Polypodium dissimile* L.** [GN]
***Polypodium fallax* Schltdl. & Cham.** [BU]
***Polypodium fraxinifolium* Jacq.** [GN]
***Polypodium hispidulum* Bartlett** [GD]
***Polypodium lindenianum* Kunze** [BU]
***Polypodium polypodioides* (L.) Watt** [GN]
Polypodium polypodioides* (L.) Watt var. *polypodioides [GN]
***Polypodium triseriale* Sw.** [GN]
***Serpocaulon dissimile* (L.) A.R. Sm.** [GN]
***Serpocaulon fraxinifolium* (Jacq.) A.R. Sm.** [GN]
***Serpocaulon triseriale* (Sw.) A.R. Sm.** [GN]
***Terpsichore asplenifolia* (L.) A.R.Sm.** [GN]
***Terpsichore lehmanniana* (Hieron.) A.R.Sm.** [BU]

PONTEDERIACEAE
***Eichhornia crassipes* (Mart.) Solms** [GN]
***Eichhornia heterosperma* Alexander** [GN]
***Heteranthera reniformis* Ruiz & Pav.** [GN]
Pontederia cordata* L. var. *cordata [GN]
***Pontederia rotundifolia* L. f.** [GN]
***Pontederia sagittata* C. Presl** [GN]

PORTULACACEAE
***Portulaca grandiflora* Hook.** [GN]
***Portulaca oleracea* L.** [GN]
***Portulaca pilosa* L.** [GN]
***Talinum paniculatum* (Jacq.) Gaertn.** [GN]

POTAMOGETONACEAE
***Potamogeton illinoensis* Morong** [GN]

PRIMULACEAE
***Ctenardisia amplifolia* (Standl.) Lundell** [GD]
***Myrsine coriacea* (Sw.) R. Br. ex Roem. & Schult.** [GN]
***Myrsine cubana* A. DC.** [BU]

PROTEACEAE
***Roupala glaberrima* Pittier** [BU]
***Roupala montana* Aubl.** [GN]
***Roupala plinervia* Cornejo & Bonifaz** [GD]

PSILOTACEAE
***Psilotum nudum* (L.) P. Beauv.** [GN]

PTERIDACEAE
***Acrostichum aureum* L.** [GN]
***Acrostichum danaeifolium* Langsd. & Fisch.** [GN]
***Adiantopsis radiata* (L.) Fée** [GN]
***Adiantum andicola* Liebm.** [GN]
***Adiantum capillus-veneris* L.** [GN]
***Adiantum concinnum* Humb. & Bonpl. ex Willd.** [GN]
***Adiantum decoratum* Maxon & Weath.** [BU]
***Adiantum fructuosum* Poepp. ex Spreng.** [BU]
***Adiantum humile* Kunze** [GN]
***Adiantum latifolium* Lam.** [GN]
***Adiantum macrophyllum* Sw.** [GN]
***Adiantum obliquum* Willd.** [GN]
***Adiantum petiolatum* Desv.** [GN]
***Adiantum princeps* T.Moore** [BU]
***Adiantum pulverulentum* L.** [GN]
***Adiantum tenerum* Sw.** [GN]

***Adiantum terminatum* Kunze ex Miq.** [GN]
***Adiantum tetraphyllum* Humb. & Bonpl. ex Willd.** [GN]
***Adiantum trapeziforme* L.** [BU]
***Adiantum trichochlaenum* Mickel & Beitel** [BU]
***Adiantum tricholepis* Fée** [BU]
***Adiantum villosum* L.** [GN]
***Adiantum wilesianum* Hook.** [BU]
***Adiantum wilsonii* Hook.** [GN]
***Anetium citrifolium* (L.) Splitg.** [GN]
***Antrophyum ensiforme* Hook.** [BU]
***Antrophyum lanceolatum* (L.) Kaulf.** [BU]
***Cheilanthes notholaenoides* (Desv.) Maxon ex Weath.** [BU]
***Hemionitis palmata* L.** [GN]
***Pityrogramma calomelanos* (L.) Link** [GN]
Pityrogramma calomelanos* (L.) Link var. *calomelanos [GN]
***Pteris altissima* Poir.** [GN]
***Pteris biaurita* L.** [GN]
***Pteris grandifolia* L.** [GN]
***Pteris longifolia* L.** [GN]
***Pteris propinqua* J. Agardh** [GN]
***Pteris pungens* Willd.** [GN]
***Pteris quadriaurita* Retz.** [GN]
***Radiovittaria stipitata* (Kunze) E.H. Crane** [GN]
***Vittaria costata* Kunze** [GN]
***Vittaria graminifolia* Kaulf.** [GN]
***Vittaria lineata* (L.) Sm.** [GN]
***Vittaria stipitata* Kunze** [GN]

PUTRANJIVACEAE
***Drypetes brownii* Standl.** [BU]
***Drypetes lateriflora* (Sw.) Krug & Urb.** [BU]

QUIINACEAE
***Quiina macrophylla* Tul.** [GN]
***Quiina schippii* Standl.** [GD]

RANUNCULACEAE
***Clematis dioica* L.** [GN]
***Clematis polygama* Jacq.** [BU]

RHAMNACEAE
***Colubrina arborescens* (Mill.) Sarg.** [GN]
***Gouania eurycarpa* Standl.** [GN]
***Gouania lupuloides* (L.) Urb.** [GN]
***Gouania obamana* A. Pool** [GD]
***Gouania polygama* (Jacq.) Urb.** [GN]
***Krugiodendron ferreum* (Vahl) Urb.** [GN]
***Rhamnus sphaerosperma* Sw.** [GN]
***Sageretia elegans* (Kunth) Brongn.** [GN]
***Ziziphus cinnamomum* Triana & Planch.** [GN]
***Ziziphus mauritiana* Lam.** [GN]

RHIZOPHORACEAE
***Cassipourea elliptica* (Sw.) Poir.** [GN]
***Cassipourea guianensis* Aubl.** [GN]
***Rhizophora mangle* L.** [GN]

ROSACEAE
***Photinia microcarpa* Standl.** [GD]
***Photinia microcarpa* Standl. subsp. *elliptica* J.B. Phipps** [GD]
Photinia microcarpa* Standl. subsp. *microcarpa [GD]
***Prunus lundelliana* Standl.** [GD]
***Prunus myrtifolia* (L.) Urb.** [GN]
***Rosa chinensis* Jacq.** [BU]
***Rubus fagifolius* Schltdl. & Cham.** [GN]

RUBIACEAE
***Alibertia edulis* (Rich.) A. Rich. ex DC.** [GN]
***Allenanthus erythrocarpus* Standl.** [GD]
***Alseis hondurensis* Standl.** [GD]
***Alseis yucatanensis* Standl.** [BU]
***Amaioua corymbosa* Kunth** [GN]
***Amaioua glomerulata* (Lam. ex Poir.) Delprete & C.H. Perss.** [GN]
***Appunia guatemalensis* Donn. Sm.** [BU]
***Arachnothryx buddleioides* (Benth.) Planch.** [BU]
***Arachnothryx stachyoidea* (Donn. Sm.) Borhidi** [GD]
***Asemnantha pubescens* Hook.f.** [GD]
***Augusta rivalis* (Benth.) J.H. Kirkbr.** [GN]
***Bertiera guianensis* Aubl.** [GN]
***Borreria capitata* (Ruiz & Pav.) DC.** [GN]
***Borreria ocymoides* (Burm. f.) DC.** [GN]
***Cephalanthus occidentalis* L.** [GN]
***Chiococca alba* (L.) Hitchc.** [GN]
***Chiococca belizensis* Lundell** [GN]
***Chiococca pachyphylla* Wernham** [BU]
***Chiococca phaenostemon* Schltr.** [BU]
***Chione venosa* (Sw.) Urb.** [GN]
***Chomelia protracta* (Bartl. ex DC.) Standl.** [BU]
***Coccocypselum guianense* (Aubl.) K. Schum.** [GN]
***Coccocypselum herbaceum* Aubl.** [GN]
***Coccocypselum hirsutum* Bartl. ex DC.** [GN]
***Coffea arabica* L.** [GN]
***Coffea liberica* W. Bull ex Hiern** [GN]
***Cosmocalyx spectabilis* Standl.** [GD]
***Coussarea imitans* L.O. Williams** [GD]
***Coussarea impetiolaris* Donn. Sm.** [GD]
***Coutarea hexandra* (Jacq.) K. Schum.** [GN]
***Crusea calocephala* DC.** [BU]
***Declieuxia fruticosa* (Willd. ex Roem. & Schult.) Kuntze** [GN]
***Diodella apiculata* (Willd. ex Roem. & Schult.) Delprete** [GN]
***Diodella sarmentosa* (Sw.) Bacigalupo & Cabral ex Borhidi** [GN]
***Diodella teres* (Walter) Small** [GN]
***Diodia serrulata* (P. Beauv.) G. Taylor** [GN]
***Erithalis fruticosa* L.** [GN]
***Ernodea littoralis* Sw.** [BU]
***Exostema caribaeum* (Jacq.) Roem. & Schult.** [BU]
***Exostema mexicanum* A. Gray** [BU]
***Faramea brachysiphon* Standl.** [GD]
***Faramea occidentalis* (L.) A. Rich.** [GN]
***Genipa americana* L.** [GN]
***Geophila macropoda* (Ruiz & Pav.) DC.** [GN]
***Geophila repens* (L.) I.M. Johnst.** [GN]
***Glossostipula concinna* (Standl.) Lorence** [GD]
***Gonzalagunia panamensis* (Cav.) K. Schum.** [GN]
***Guettarda combsii* Urb.** [BU]
***Guettarda crispiflora* Vahl** [GN]
***Guettarda davidseorum* Lorence** [BK]
***Guettarda deamii* Standl.** [BU]
***Guettarda elliptica* Sw.** [BU]
***Guettarda foliacea* Standl.** [BU]
***Guettarda gaumeri* Standl.** [GD]
***Guettarda macrosperma* Donn. Sm.** [BU]
***Guettarda subcapitata* C.M. Taylor** [GD]
***Guettarda tikalana* Lundell** [GD]
***Hamelia axillaris* Sw.** [GN]
***Hamelia calycosa* Donn. Sm.** [GN]
***Hamelia patens* Jacq.** [GN]
Hamelia patens* Jacq. var. *patens [GN]
***Hamelia rovirosae* Wernham** [BU]
***Hillia panamensis* Standl.** [BU]

***Hillia tetrandra* Sw.** [BU]
***Hoffmannia bullata* L.O. Williams** [BU]
***Hoffmannia discolor* (Lem.) Hemsl.** [GD]
***Hoffmannia ghiesbreghtii* (Lem.) Hemsl.** [GD]
***Hoffmannia nicotianifolia* (M. Martens & Galeotti) L.O. Williams** [BU]
***Hoffmannia regalis* (Hook.f.) Hemsl.** [BU]
***Hoffmannia rhizantha* Standl.** [GD]
***Ixora coccinea* L.** [GN]
***Ixora finlaysoniana* Wall. ex G. Don** [GN]
***Ixora nicaraguensis* Wernham** [BU]
***Machaonia acuminata* Bonpl.** [GN]
***Machaonia cymosa* (Sw.) Griseb.** [GD]
***Machaonia havanensis* (Jacq. ex J.F. Gmel.) Alain** [GN]
***Machaonia lindeniana* Baill.** [BU]
***Malanea erecta* Seem.** [BU]
***Manettia reclinata* L.** [GN]
***Margaritopsis microdon* (DC.) C.M. Taylor** [GN]
***Mitracarpus hirtus* (L.) DC.** [GN]
***Mitracarpus rhadinophyllus* (B.L.Rob.) L.O. Williams** [GD]
***Morinda citrifolia* L.** [GN]
***Morinda panamensis* Seem.** [BU]
***Morinda royoc* L.** [GN]
***Notopleura anomothyrsa* (K. Schum. & Donn. Sm.) C.M. Ta** [GN]
***Notopleura guadalupensis* (DC.) C.M. Taylor** [GN]
***Notopleura uliginosa* (Sw.) Bremek.** [GN]
***Oldenlandia corymbosa* L.** [GN]
***Oldenlandia lancifolia* (Schumach.) DC.** [GN]
***Palicourea crocea* (Sw.) Schult.** [GN]
***Palicourea domingensis* (Jacq.) DC.** [GN]
***Palicourea guianensis* Aubl.** [GN]
***Palicourea padifolia* (Humb. & Bonpl. ex Schult.) C.M. Taylor & Lorence** [GN]
***Palicourea tetragona* (Donn. Sm.) C.M. Taylor & Lorence** [BU]
***Palicourea triphylla* DC.** [GN]
***Pentas lanceolata* (Forssk.) Deflers** [GN]
***Pentodon pentandrus* (Schumach. & Thonn.) Vatke** [GN]
***Posoqueria latifolia* (Rudge) Schult.** [GN]
***Psychotria acuminata* Benth.** [GN]
***Psychotria berteroana* DC.** [GN]
***Psychotria brachiata* Sw.** [GN]
***Psychotria buchtienii* (H.J.P. Winkl.) Standl.** [GN]
***Psychotria capitata* Ruiz & Pav.** [GN]
***Psychotria carthagenensis* Jacq.** [GN]
***Psychotria costivenia* Griseb.** [GN]
Psychotria costivenia* Griseb. var. *costivenia [GN]
***Psychotria cyanococca* Seem. ex Dombrain** [GN]
***Psychotria deflexa* DC.** [GN]
***Psychotria elata* (Sw.) Hammel** [GN]
***Psychotria fruticetorum* Standl.** [BU]
***Psychotria glomerulata* (Donn. Sm.) Steyerm.** [GN]
***Psychotria gracilenta* Müll.Arg.** [GN]
***Psychotria graciliflora* Benth.** [BU]
***Psychotria grandis* Sw.** [GN]
***Psychotria hebeclada* DC.** [GN]
***Psychotria hispidula* Standl. ex Steyerm.** [GN]
***Psychotria hoffmannseggiana* (Willd. ex Roem. & Schult.) Müll.Arg.** [GN]
***Psychotria horizontalis* Sw.** [GN]
***Psychotria limonensis* K. Krause** [GN]
***Psychotria lundellii* Standl.** [GD]
***Psychotria marginata* Sw.** [GN]
***Psychotria mexiae* Standl.** [GN]
***Psychotria nervosa* Sw.** [GN]
***Psychotria officinalis* (Aubl.) Raeusch. ex Sandwith** [BU]
***Psychotria panamensis* Standl.** [GN]
Psychotria panamensis* Standl. var. *panamensis [GN]
***Psychotria papantlensis* (Oerst.) Hemsl.** [GD]

Psychotria pleuropoda **Donn. Sm.** [GD]
Psychotria poeppigiana **Müll.Arg.** [GN]
Psychotria pubescens **Sw.** [GN]
Psychotria quinqueradiata **Pol.** [BU]
Psychotria racemosa **Rich.** [GN]
Psychotria sarapiquensis **Standl.** [BU]
Psychotria simiarum **Standl.** [BU]
Psychotria tenuifolia **Sw.** [GN]
Psychotria trichotoma **M. Martens & Galeotti** [GN]
Psychotria uliginosa **Sw.** [GN]
Randia aculeata **L.** [GN]
Randia aculeata **L. var.** ***aculeata*** [GN]
Randia armata **(Sw.) DC.** [GN]
Randia cookii **Standl.** [GD]
Randia genipifolia **(Standl. & Steyerm.) Lorence** [BK]
Randia laetevirens **Standl.** [GD]
Randia matudae **Lorence & Dwyer** [BU]
Randia monantha **Benth.** [BU]
Randia petenensis **Lundell** [GD]
Randia retroflexa **Lorence & M. Nee** [GD]
Richardia scabra **L.** [GN]
Rogiera stenosiphon **(Hemsl.) Borhidi** [GD]
Ronabea latifolia **Aubl.** [GN]
Rondeletia belizensis **Standl.** [GD]
Rudgea cornifolia **(Kunth) Standl.** [GN]
Sabicea panamensis **Wernham** [GN]
Sabicea villosa **Schult.** [GN]
Sabicea villosa **Willd. ex Roem. & Schult. var.** ***villosa*** [GN]
Simira salvadorensis **(Standl.) Steyerm.** [GD]
Spermacoce alata **(Aubl.) DC.** [GN]
Spermacoce densiflora **(DC.) Alain** [GN]
Spermacoce exilis **(L.O. Williams) C.D. Adams** [GN]
Spermacoce latifolia **Aubl.** [GN]
Spermacoce ocymifolia **Willd. ex Roem. & Schult.** [GN]
Spermacoce prostrata **Aubl.** [GN]
Spermacoce remota **Lam.** [GN]
Spermacoce suaveolens **(G.Mey.) Kuntze** [GN]
Spermacoce tenuior **L.** [GN]
Spermacoce tetraquetra **A. Rich.** [BU]
Spermacoce verticillata **L.** [GN]
Stenostomum lucidum **(Sw.) C.F. Gaertn.** [GD]
Strumpfia maritima **Jacq.** [GD]
Uncaria tomentosa **(Willd.) DC.** [GN]

RUTACEAE
Amyris balsamifera **L.** [GN]
Amyris elemifera **L.** [GN]
Amyris rhomboidea **Standl.** [BK]
Amyris sylvatica **Jacq.** [BU]
Casimiroa tetrameria **Millsp.** [BU]
Citrus aurantiifolia **(Christm.) Swingle** [GN]
Citrus aurantium **L.** [GN]
Citrus sinensis **(L.) Osbeck** [GN]
Murraya paniculata **(L.) Jack** [GN]
Pilocarpus racemosus **Vahl** [GN]
Ruta chalepensis **L.** [GN]
Triphasia trifolia **(Burm. f.) P. Wilson** [GN]
Zanthoxylum acuminatum **(Sw.) Sw.** [GN]
Zanthoxylum caribaeum **Lam.** [GN]
Zanthoxylum ekmanii **(Urb.) Alain** [GN]
Zanthoxylum juniperinum **Poepp.** [BU]
Zanthoxylum melanostictum **Schltdl. & Cham.** [GN]
Zanthoxylum panamense **P. Wilson** [BU]
Zanthoxylum petenense **Lundell** [BK]
Zanthoxylum riedelianum **Engl.** [GN]

Zanthoxylum riedelianum **Engl. subsp.** ***kellermanii*** **(P. Wilson) Reynel** [GN]
Zanthoxylum setulosum **P. Wilson** [BU]

SACCOLOMATACEAE
Saccoloma elegans **Kaulf.** [GN]
Saccoloma elegans **Kaulf. subsp.** ***chartaceum*** **G.B.Nair ex Cremers & K.U. Kramer** [GN]
Saccoloma inaequale **(Kunze) Mett.** [GN]

SALICACEAE
Bartholomaea sessiliflora **(Standl.) Standl. & Steyerm.** [GD]
Casearia aculeata **Jacq.** [GN]
Casearia arborea **(Rich.) Urb.** [GN]
Casearia arguta **Kunth** [GN]
Casearia bartlettii **Lundell** [GD]
Casearia commersoniana **Cambess.** [GN]
Casearia corymbosa **Kunth** [GN]
Casearia decandra **Jacq.** [GN]
Casearia nitida **Jacq.** [BU]
Casearia sylvestris **Sw.** [GN]
Casearia tacanensis **Lundell** [BU]
Casearia tremula **(Griseb.) Griseb. ex C. Wright** [GN]
Homalium racemosum **Jacq.** [GN]
Laetia procera **(Poepp.) Eichler** [GN]
Laetia thamnia **L.** [BU]
Macrohasseltia macroterantha **(Standl. & L.O. Williams) L.O. Williams** [GD]
Pleuranthodendron lindenii **(Turcz.) Sleumer** [GN]
Prockia crucis **P. Browne ex L.** [GN]
Salix humboldtiana **Willd.** [GN]
Xylosma characantha **Standl.** [BU]
Xylosma cinerea **(Clos) Hemsl.** [BU]
Xylosma flexuosa **(Kunth) Hemsl.** [GN]
Xylosma oligandra **Donn. Sm.** [BU]
Xylosma panamensis **Turcz.** [BU]
Zuelania guidonia **(Sw.) Britton & Millsp.** [GN]

SALVINIACEAE
Salvinia auriculata **Aubl.** [GN]
Salvinia minima **Baker** [GN]

SANTALACEAE
Arceuthobium hawksworthii **Wiens & C.G. Shaw** [BK]
Arceuthobium vaginatum **(Humb. & Bonpl. ex Willd.) J. P** [GD]
Dendrophthora guatemalensis **Standl.** [GD]
Phoradendron chrysocladon **A. Gray** [GN]
Phoradendron crassifolium **(Pohl ex DC.) Eichler** [GN]
Phoradendron hexastichum **(DC.) Griseb.** [GN]
Phoradendron heydeanum **Trel.** [GD]
Phoradendron lundellii **Kuijt** [BK]
Phoradendron mucronatum **(DC.) Krug & Urb.** [GN]
Phoradendron nervosum **Oliv.** [GN]
Phoradendron pedicellatum **(Tiegh.) Kuijt** [GD]
Phoradendron piperoides **(Kunth) Trel.** [GN]
Phoradendron quadrangulare **(Kunth) Krug & Urb.** [GN]
Phoradendron robustissimum **Eichler** [BU]
Phoradendron tonduzii **Trel.** [BU]
Phoradendron trinervium **(Lam.) Griseb.** [GN]

SAPINDACEAE
Allophylus camptostachys **Radlk.** [GD]
Allophylus cominia **(L.) Sw.** [GN]
Allophylus psilospermus **Radlk.** [GN]
Blighia sapida **K.D. Koenig** [GN]
Blomia prisca **(Standl.) Lundell** [GD]
Cardiospermum grandiflorum **Sw.** [GN]
Cupania belizensis **Standl.** [BU]

***Cupania dentata* DC.** [BU]
***Cupania glabra* Sw.** [BU]
***Cupania guatemalensis* (Turcz.) Radlk.** [BU]
***Cupania rufescens* Triana & Planch.** [GN]
***Cupania scrobiculata* Rich.** [GN]
***Cupania spectabilis* Radlk.** [GD]
***Dodonaea viscosa* Jacq.** [GN]
***Exothea diphylla* (Standl.) Lundell** [GD]
***Exothea paniculata* (Juss.) Radlk.** [GN]
***Matayba apetala* Radlk.** [BU]
***Matayba clavelligera* Radlk.** [BU]
***Matayba oppositifolia* (A. Rich.) Britt.** [GN]
***Melicoccus bijugatus* Jacq.** [GN]
***Paullinia clavigera* Schltdl.** [GN]
***Paullinia costaricensis* Radlk.** [BU]
***Paullinia costata* Schltdl. & Cham.** [BU]
***Paullinia cururu* L.** [GN]
***Paullinia fuscescens* Kunth** [GN]
***Paullinia pinnata* L.** [GN]
***Paullinia tomentosa* Jacq.** [BU]
***Sapindus saponaria* L.** [GN]
***Serjania acuta* Triana & Planch.** [BU]
***Serjania adiantoides* Radlk.** [GD]
***Serjania atrolineata* C. Wright** [GN]
***Serjania brachylopha* Radlk.** [BK]
***Serjania cambessedeana* Schltdl. & Cham.** [GD]
***Serjania caracasana* (Jacq.) Willd.** [GN]
***Serjania goniocarpa* Radlk.** [BU]
***Serjania grosii* Schltdl.** [BU]
***Serjania lethalis* A. St.-Hil.** [GN]
***Serjania lundellii* Croat** [GD]
***Serjania macrocarpa* Standl. & Steyerm.** [BU]
***Serjania mexicana* (L.) Willd.** [GN]
***Serjania paniculata* Kunth** [GN]
***Serjania paucidentata* DC.** [GN]
***Serjania pterarthra* Standl.** [GD]
***Serjania yucatanensis* Standl.** [GD]
***Thouinia paucidentata* Radlk.** [GD]
***Urvillea ulmacea* Kunth** [GN]

SAPOTACEAE
***Chrysophyllum cainito* L.** [GN]
***Chrysophyllum mexicanum* Brandegee ex Standl.** [BU]
***Chrysophyllum venezuelanense* (Pierre) T.D. Penn.** [GN]
***Manilkara chicle* (Pittier) Gilly** [BU]
***Manilkara staminodella* Gilly** [GD]
***Manilkara zapota* (L.) P. Royen** [GN]
***Micropholis melinoniana* Pierre** [GN]
***Pouteria amygdalina* (Standl.) Baehni** [BK]
***Pouteria belizensis* (Standl.) Cronquist** [GD]
***Pouteria campechiana* (Kunth) Baehni** [GN]
***Pouteria durlandii* (Standl.) Baehni** [GN]
Pouteria durlandii* (Standl.) Baehni subsp. *durlandii [GN]
***Pouteria izabalensis* (Standl.) Baehni** [GD]
***Pouteria reticulata* (Engl.) Eyma** [GN]
Pouteria reticulata* (Engl.) Eyma subsp. *reticulata [GN]
***Pouteria sapota* (Jacq.) H.E.Moore & Stearn** [GN]
***Pouteria torta* (Mart.) Radlk.** [GN]
***Pouteria torta* (Mart.) Radlk. subsp. *gallifructa* (Cronquist) T.D. Penn.** [GN]
***Pouteria torta* (Mart.) Radlk. subsp. *tuberculata* (Sleumer) T.D. Penn.** [GN]
***Sideroxylon americanum* (Mill.) T.D. Penn.** [GD]
***Sideroxylon capiri* (A. DC.) Pittier subsp. *tempisque* (Pittier) T.D. Penn.** [BU]
***Sideroxylon durifolium* (Standl.) T.D. Penn.** [BK]
***Sideroxylon floribundum* Griseb.** [GD]
***Sideroxylon floribundum* Griseb. subsp. *belizense* (Lundell) T.D. Penn.** [GD]

***Sideroxylon foetidissimum* Jacq.** [BU]
***Sideroxylon foetidissimum* Jacq. subsp. *gaumeri* (Pittier) T.D. Penn.** [GD]
***Sideroxylon obtusifolium* (Humb. ex Roem. & Schult.) T.D. Penn.** [GN]
***Sideroxylon obtusifolium* (Humb. ex Roem. & Schult.) T.D. Penn. subsp. *buxifolium* (Roem. & Schult.) T.D. Penn.** [GN]
***Sideroxylon persimile* (Hemsl.) T.D. Penn.** [GN]
Sideroxylon persimile* (Hemsl.) T.D. Penn. subsp. *persimile [GN]
***Sideroxylon salicifolium* (L.) Lam.** [BU]

SCHIZAEACEAE
***Schizaea elegans* (Vahl) Sm.** [GN]
***Schizaea poeppigiana* J.W. Sturm** [GN]

SCHLEGELIACEAE
***Schlegelia nicaraguensis* Standl.** [BU]
***Schlegelia parviflora* (Oerst.) Monach.** [GN]

SCROPHULARIACEAE
***Alectra aspera* (Cham. & Schltdl.) L.O. Williams** [GN]
***Buddleja americana* L.** [GN]
***Capraria biflora* L.** [GN]
***Capraria mexicana* Moric. ex Benth.** [GD]

SELAGINELLACEAE
***Selaginella cladorrhizans* A. Braun** [GN]
***Selaginella eurynota* A. Braun** [BU]
***Selaginella flagellata* Spring** [GN]
***Selaginella guatemalensis* Baker** [GD]
***Selaginella hoffmannii* Hieron.** [BU]
***Selaginella huehuetenangensis* Hieron.** [BU]
***Selaginella idiospora* Alston** [GD]
***Selaginella microdendron* Baker** [GD]
***Selaginella mollis* A. Braun** [BU]
***Selaginella ovifolia* Baker** [GD]
***Selaginella pallescens* (C. Presl) Spring** [GN]
***Selaginella pallescens* (C. Presl) Spring var. *acutifolia* Stolze** [GN]
Selaginella pallescens* (C. Presl) Spring var. *pallescens [GN]
***Selaginella schiedeana* A. Braun** [GD]
***Selaginella sertata* Spring** [BU]
***Selaginella silvestris* Aspl.** [GN]
***Selaginella stellata* Spring** [BU]
***Selaginella tenella* (P. Beauv.) Spring** [BU]
***Selaginella umbrosa* Lem. ex Hieron.** [GN]

SIMAROUBACEAE
***Simarouba amara* Aubl.** [GN]
***Simarouba glauca* DC.** [GN]

SIPARUNACEAE
***Siparuna thecaphora* (Poepp. & Endl.) A. DC.** [GN]

SMILACACEAE
***Smilax aristolochiifolia* Mill.** [BU]
***Smilax domingensis* Willd.** [GN]
***Smilax mollis* Humb. & Bonpl. ex Willd.** [GN]
***Smilax officinalis* Kunth** [GN]
***Smilax regelii* Killip & C.V. Morton** [GD]
***Smilax spinosa* Mill.** [GN]
***Smilax subpubescens* A. DC.** [GN]
***Smilax velutina* Killip & C.V. Morton** [BU]

SOLANACEAE
***Brachistus nelsonii* (Fernald) D'Arcy, J.L. Gentry** [BU]
***Browallia americana* L.** [GN]
***Capsicophysalis potosina* (Rob. & Greenm.) Averett & M. Martínez** [GD]
***Capsicum annuum* L.** [GN]

***Capsicum annuum* L. var. *glabriusculum* (Dunal) Heiser & Pickersgill** [GN]
***Capsicum chinense* Jacq.** [GN]
***Cestrum alternifolium* (Jacq.) O.E. Schulz** [GN]
***Cestrum nocturnum* L.** [GN]
***Cestrum racemosum* Ruiz & Pav.** [GN]
***Cestrum scandens* Vahl** [GN]
***Cestrum schlechtendalii* G. Don** [GN]
***Cyphomandra rojasiana* Standl. & Steyerm.** [GD]
***Jaltomata procumbens* (Cav.) J.L. Gentry** [GN]
***Lycianthes amatitlanensis* (J.M. Coult. & Donn. Sm.) Bitter** [GN]
***Lycianthes gorgonea* Bitter** [GD]
***Lycianthes heteroclita* (Sendtn.) Bitter** [GN]
***Lycianthes hypoleuca* Standl.** [GD]
***Lycianthes lenta* (Cav.) Bitter** [GN]
***Lycianthes limitanea* (Standl.) J.L. Gentry** [GD]
***Lycianthes multiflora* Bitter** [BU]
***Lycianthes nitida* Bitter** [BU]
***Lycianthes purpusii* (Brandegee) Bitter** [BU]
***Lycianthes sideroxyloides* (Schltdl.) Bitter** [GD]
***Lycianthes stephanocalyx* (Brandegee) Bitter** [GD]
***Lycianthes synanthera* (Sendtn.) Bitter** [GN]
***Melananthus guatemalensis* (Benth. ex Hemsl.) ex Soler** [GN]
***Merinthopodium neuranthum* (Hemsl.) Donn. Sm.** [BU]
***Nicotiana tabacum* L.** [GN]
***Physalis angulata* L.** [GN]
***Physalis gracilis* Miers** [BU]
***Physalis lagascae* Roem. & Schult.** [GN]
***Physalis philadelphica* Lam.** [GN]
***Physalis pubescens* L.** [GN]
***Schwenckia americana* L.** [GN]
***Schwenckia americana* L. var. *angustifolia* J.A. Schmidt** [GN]
***Solandra maxima* (Sessé & Moc.) P.S.Green** [BU]
***Solanum acerifolium* Dunal** [GN]
***Solanum americanum* Mill.** [GN]
***Solanum appendiculatum* Dunal** [GN]
***Solanum asperum* Rich.** [GN]
***Solanum aturense* Dunal** [GN]
***Solanum campechiense* L.** [GN]
***Solanum candidum* Lindl.** [GN]
***Solanum cordovense* Sessé & Moc.** [GN]
***Solanum diphyllum* L.** [GN]
***Solanum donianum* Walp.** [GD]
***Solanum erianthum* D. Don** [GN]
***Solanum erythrotrichum* Fernald** [GN]
***Solanum hirtum* Vahl** [GN]
***Solanum jamaicense* Mill.** [GN]
***Solanum lanceifolium* Jacq.** [GN]
***Solanum lanceolatum* Cav.** [BU]
***Solanum lepidotum* Dunal** [GN]
***Solanum lycopersicum* L.** [GN]
***Solanum mammosum* L.** [GN]
***Solanum myriacanthum* Dunal** [GN]
***Solanum nigrescens* M. Martens & Galeotti** [GN]
***Solanum nudum* Dunal** [GN]
***Solanum phaseoloides* Pol.** [BU]
***Solanum rovirosanum* Donn. Sm.** [BU]
***Solanum rudepannum* Dunal** [GN]
***Solanum rugosum* Dunal** [GN]
***Solanum schlechtendalianum* Walp.** [GN]
***Solanum seaforthianum* Andrews** [GN]
***Solanum suaveolens* Kunth & C. D. Bouché** [BU]
***Solanum tampicense* Dunal** [GN]
***Solanum torvum* Sw.** [GN]
***Solanum umbellatum* Mill.** [GN]
***Solanum volubile* Sw.** [GN]

Witheringia solanacea **L'Hér.** [GN]

SPHENOCLEACEAE
Sphenoclea zeylanica **Gaertn.** [GN]

STRELITZIACEAE
Ravenala madagascariensis **Sonn.** [GN]

STYRACACEAE
Styrax argenteus **C. Presl** [GN]
Styrax glabrescens **Benth.** [BU]

SURIANACEAE
Suriana maritima **L.** [GN]

SYMPLOCACEAE
Symplocos bicolor **L.O. Williams** [GD]
Symplocos jurgensenii **Hemsl.** [GD]
Symplocos limoncillo **Humb. & Bonpl.** [GN]
Symplocos martinicensis **Jacq.** [GN]

TAPISCIACEAE
Turpinia occidentalis **(Sw.) G. Don** [GN]

TECTARIACEAE
Dictyoxiphium panamense **Hook.** [BU]
Tectaria heracleifolia **(Willd.) Underw.** [GN]
Tectaria heracleifolia **(Willd.) Underw. var. *heracleifolia*** [BU]
Tectaria incisa **Cav.** [GN]
Tectaria mexicana **(Fée) C.V. Morton** [BU]
Tectaria nicotianifolia **(Baker) C. Chr.** [GN]
Tectaria plantaginea **(Jacq.) Maxon** [GN]
Tectaria rivalis **(Mett. ex Kuhn) C. Chr.** [GN]
Tectaria trifoliata **(L.) Cav.** [GN]
Tectaria vivipara **Jermy & T.G. Walker** [BU]

THELYPTERIDACEAE
Macrothelypteris torresiana **(Gaudich.) Ching** [GN]
Thelypteris angustifolia **(Willd.) Proctor** [GN]
Thelypteris atrovirens **(C. Chr.) C.F. Reed** [BU]
Thelypteris balbisii **(Spreng.) Ching** [GN]
Thelypteris biolleyi **(H. Christ) Proctor** [GN]
Thelypteris blanda **(Fée) C.F. Reed** [GD]
Thelypteris concinna **(Willd.) Ching** [GN]
Thelypteris decussata **(L.) Proctor** [GN]
Thelypteris dentata **(Forssk.) E.P. St. John** [GN]
Thelypteris falcata **(Liebm.) R.M. Tryon** [GN]
Thelypteris ghiesbreghtii **(Hook.) C.V. Morton** [BU]
Thelypteris glandulosa **(Desv.) Proctor var. *brachyodus* (Kunze) A.R.Sm.** [BU]
Thelypteris hispidula **(Decne.) C.F. Reed** [GN]
Thelypteris hondurensis **L.D. Gómez** [GD]
Thelypteris interrupta **(Willd.) K. Iwats.** [GN]
Thelypteris kunthii **(Desv.) C.V. Morton** [GN]
Thelypteris linkiana **(C. Presl) R.M. Tryon** [GN]
Thelypteris nicaraguensis **(E.Fourn.) C.V. Morton** [GN]
Thelypteris obliterata **(Sw.) Proctor** [BU]
Thelypteris ovata **R.P. St. John** [GD]
Thelypteris ovata **R.P. St. John var. *lindheimeri* (C. Chr.) A.R.Sm.** [GD]
Thelypteris patens **(Sw.) Small** [GN]
Thelypteris patens **(Sw.) Small var. *patens*** [GN]
Thelypteris paucipinnata **(Donn. Sm.) C.F. Reed** [GD]
Thelypteris poiteana **(Bory) Proctor** [GN]
Thelypteris praetermissa **(Maxon) A.R.Sm.** [GD]
Thelypteris puberula **(Baker) C.V. Morton var. *puberula*** [BU]
Thelypteris reptans **(J.F. Gmel.) C.V. Morton** [GN]

***Thelypteris resiliens* (Maxon) A.R.Sm.** [GD]
***Thelypteris resinifera* (Desv.) Proctor** [GN]
***Thelypteris sancta* (L.) Ching** [BU]
***Thelypteris serrata* (Cav.) Alston** [GN]
***Thelypteris skinneri* (Hook.) C.F. Reed** [GD]
***Thelypteris tetragona* (Sw.) Small** [GN]
***Thelypteris toganetra* A.R.Sm.** [GD]

THEOPHRASTACEAE
***Bonellia albiflora* (Lundell) B. Ståhl & Källersjö** [GD]
***Bonellia longifolia* (Standl.) B. Ståhl & Källersjö** [GD]
Bonellia macrocarpa* (Cav.) B. Ståhl & Källersjö subsp. *macrocarpa [BU]
***Bonellia paludicola* (Standl.) B. Ståhl & Källersjö** [BK]
***Deherainia smaragdina* (Planch. ex Linden) Decne.** [GD]
***Deherainia smaragdina* (Planch. ex Linden) Decne. subsp. *occidentalis* Stahl** [GD]
Deherainia smaragdina* (Planch. ex Linden) Decne. subsp. *smaragdina [GD]
***Samolus ebracteatus* Kunth** [GN]

TOVARIACEAE
***Tovaria pendula* Ruiz & Pav.** [GN]

TRIGONIACEAE
***Trigonia eriosperma* (Lam.) Fromm & Santos** [GN]
***Trigonia eriosperma* (Lam.) Fromm & E. Santos subsp. *membranacea* (A.C.Sm.) Lleras** [GN]

TURNERACEAE
***Erblichia odorata* Seem.** [BU]
Erblichia odorata* Seem. var. *odorata [GD]
***Piriqueta cistoides* (L.) Griseb.** [GN]
Piriqueta viscosa* Griseb. subsp. *viscosa [GN]
***Turnera aromatica* Arbo** [BU]
***Turnera curassavica* Urb.** [BU]
***Turnera diffusa* Willd. ex Schult.** [GN]
***Turnera diffusa* Willd. ex Schult. var. *aphrodisiaca* (Ward) Urb.** [GN]
***Turnera odorata* Rich.** [GN]
***Turnera panamensis* Urb.** [GD]
***Turnera pumilea* L.** [GN]
***Turnera scabra* Millsp.** [GN]
***Turnera ulmifolia* L.** [GN]

TYPHACEAE
***Typha domingensis* Pers.** [GN]

ULMACEAE
***Ampelocera hottlei* (Standl.) Standl.** [BU]

URTICACEAE
***Boehmeria caudata* Sw.** [GN]
***Boehmeria cylindrica* (L.) Sw.** [GN]
***Boehmeria ramiflora* Jacq.** [GN]
***Boehmeria ulmifolia* Wedd.** [GN]
***Cecropia obtusifolia* Bertol.** [GN]
***Cecropia peltata* L.** [GN]
***Coussapoa oligocephala* Donn. Sm.** [GD]
***Gyrotaenia microcarpa* Fawc. & Rendle** [GD]
***Laportea aestuans* (L.) Chew** [GN]
***Myriocarpa heterospicata* Donn. Sm.** [GD]
***Myriocarpa longipes* Liebm.** [GN]
***Myriocarpa obovata* Donn. Sm.** [BU]
***Phenax mexicanus* Wedd.** [GN]
***Pilea chiapensis* Killip** [GD]
***Pilea ecboliophylla* Donn. Sm.** [BU]
***Pilea glabra* S. Watson** [BU]
***Pilea hyalina* Fenzl** [GN]
***Pilea microphylla* (L.) Liebm.** [GN]

***Pilea pansamalana* Donn. Sm.** [GD]
***Pilea pubescens* Liebm.** [GN]
***Pilea riparia* Donn. Sm.** [GD]
***Pourouma bicolor* Mart.** [GN]
***Pourouma bicolor* Mart. subsp. *scobina* (Benoist) C.C. Berg & Heusden** [GN]
***Pouzolzia obliqua* (Wedd.) Wedd.** [GN]
***Rousselia humilis* (Sw.) Urb.** [GD]
***Urera baccifera* (L.) Gaudich. ex Wedd.** [GN]
***Urera caracasana* (Jacq.) Gaudich. ex Griseb.** [GN]
***Urera simplex* Wedd.** [GN]

VERBENACEAE
***Bouchea prismatica* (L.) Kuntze** [GN]
***Citharexylum affine* D. Don** [BU]
***Citharexylum caudatum* L.** [GN]
***Citharexylum crassifolium* Greenm.** [GD]
***Citharexylum hexangulare* Greenm.** [BU]
***Citharexylum hirtellum* Standl.** [GD]
***Lantana camara* L.** [GN]
***Lantana involucrata* L.** [GN]
***Lantana trifolia* L.** [GN]
***Lippia alba* (Mill.) N.E. Br. ex Britton & P. Wilson** [GN]
***Lippia graveolens* Kunth** [GN]
***Lippia myriocephala* Schltdl. & Cham.** [BU]
***Lippia umbellata* Cav.** [GN]
***Petrea volubilis* L.** [GN]
***Phyla nodiflora* (L.) Greene** [GN]
***Phyla stoechadifolia* (L.) Small** [BU]
***Priva lappulacea* (L.) Pers.** [GN]
***Rehdera penninervia* Standl. & Moldenke** [BK]
***Stachytarpheta angustifolia* (Mill.) Vahl** [GN]
***Stachytarpheta cayennensis* (Rich.) Vahl** [GN]
***Stachytarpheta frantzii* Pol.** [GN]
***Stachytarpheta jamaicensis* (L.) Vahl** [GN]
***Stachytarpheta miniacea* Moldenke** [GD]
***Tamonea spicata* Aubl.** [GN]
***Verbena litoralis* Kunth** [GN]

VIOLACEAE
***Corynostylis arborea* (L.) S.F. Blake** [GN]
***Hybanthus attenuatus* (Humb. & Bonpl.) Schulze-Menz** [GN]
***Hybanthus calceolaria* (L.) Oken** [GN]
***Hybanthus galeottii* (Turcz.) C.V. Morton** [BU]
***Hybanthus oppositifolius* (L.) Taub.** [GN]
***Hybanthus sylvicola* Standl. & Steyerm.** [BK]
***Hybanthus thiemei* (Donn. Sm.) C.V. Morton** [BU]
***Orthion malpighiifolium* (Standl.) Standl. & Steyerm.** [BK]
***Orthion subsessile* (Standl.) Standl. & Steyerm.** [BK]
***Rinorea deflexiflora* Bartlett** [BU]
***Rinorea guatemalensis* (S. Watson) Bartlett** [BU]
***Rinorea hummelii* Sprague** [GN]
***Rinorea squamata* S.F. Blake** [GN]
***Rinorea sylvatica* (Seem.) Kuntze** [GD]

VITACEAE
***Cissus biformifolia* Standl.** [GN]
***Cissus cacuminis* Standl.** [BU]
***Cissus erosa* Rich.** [GN]
***Cissus gossypiifolia* Standl.** [BU]
***Cissus microcarpa* Vahl** [GN]
***Cissus obliqua* Ruiz & Pav.** [BU]
***Cissus sicyoides* L.** [GN]
***Cissus verticillata* (L.) Nicolson & C.E. Jarvis** [GN]
***Vitis popenoei* Fennell** [GD]
***Vitis tiliifolia* Humb. & Bonpl. ex Roem. & Schult.** [GN]

VOCHYSIACEAE
Vochysia guatemalensis **Donn. Sm.** [BU]
Vochysia hondurensis **Sprague** [BU]

WOODSIACEAE
Diplazium cristatum **(Desr.) Alston** [GN]
Diplazium grandifolium **(Sw.) Sw.** [GN]
Diplazium lonchophyllum **Kunze** [GN]
Diplazium neglectum **(H. Karst.) C. Chr.** [BU]
Diplazium nelsonianum **A. Rojas** [GD]
Diplazium plantaginifolium **(L.) Urb.** [GN]
Diplazium riedelianum **(Bong. ex Kuhn) Kuhn ex C. Chr.** [GN]
Diplazium striatastrum **Lellinger** [BU]
Diplazium striatum **(L.) C. Presl** [GN]
Diplazium ternatum **Liebm.** [GD]
Diplazium werckleanum **H. Christ** [BU]

XANTHORRHOEACEAE
Aloe vera **(L.) Burm. f.** [GN]

XYRIDACEAE
Xyris ambigua **Beyr. ex Kunth** [BU]
Xyris baldwiniana **Schult.** [GD]
Xyris difformis **Chapm. var. *curtissii* (Malme) Kral** [GD]
Xyris elliottii **Chapm.** [BU]
Xyris floridana **(Kral) E.L. Bridges & Orzell** [BK]
Xyris jupicai **Rich.** [GN]
Xyris navicularis **Griseb.** [BU]
Xyris paraensis **Poepp. ex Kunth** [GN]
Xyris smalliana **Nash** [GD]

ZAMIACEAE
Ceratozamia mexicana **Brongn.** [GD]
Ceratozamia robusta **Miq.** [GD]
Zamia decumbens **Calonje, Meerman, M.P. Griff. & Hoese** [BK]
Zamia furfuracea **L. f. ex Aiton** [GD]
Zamia loddigesii **Miq.** [BU]
Zamia meermanii **Calonje** [BK]
Zamia prasina **W. Bull** [GD]
Zamia tuerckheimii **Donn. Sm.** [GD]

ZINGIBERACEAE
Curcuma longa **L.** [GN]
Hedychium coronarium **J. König** [GN]
Renealmia alpinia **(Rottb.) Maas** [GN]
Renealmia aromatica **(Aubl.) Griseb.** [GN]
Renealmia mexicana **Klotzsch ex Petersen** [GN]
Zingiber officinale **Roscoe** [GN]

ZYGOPHYLLACEAE
Kallstroemia maxima **(L.) Hook. & Arn.** [GN]

APPENDIX III

Dot maps for Black, Gold, Blue and Green Stars

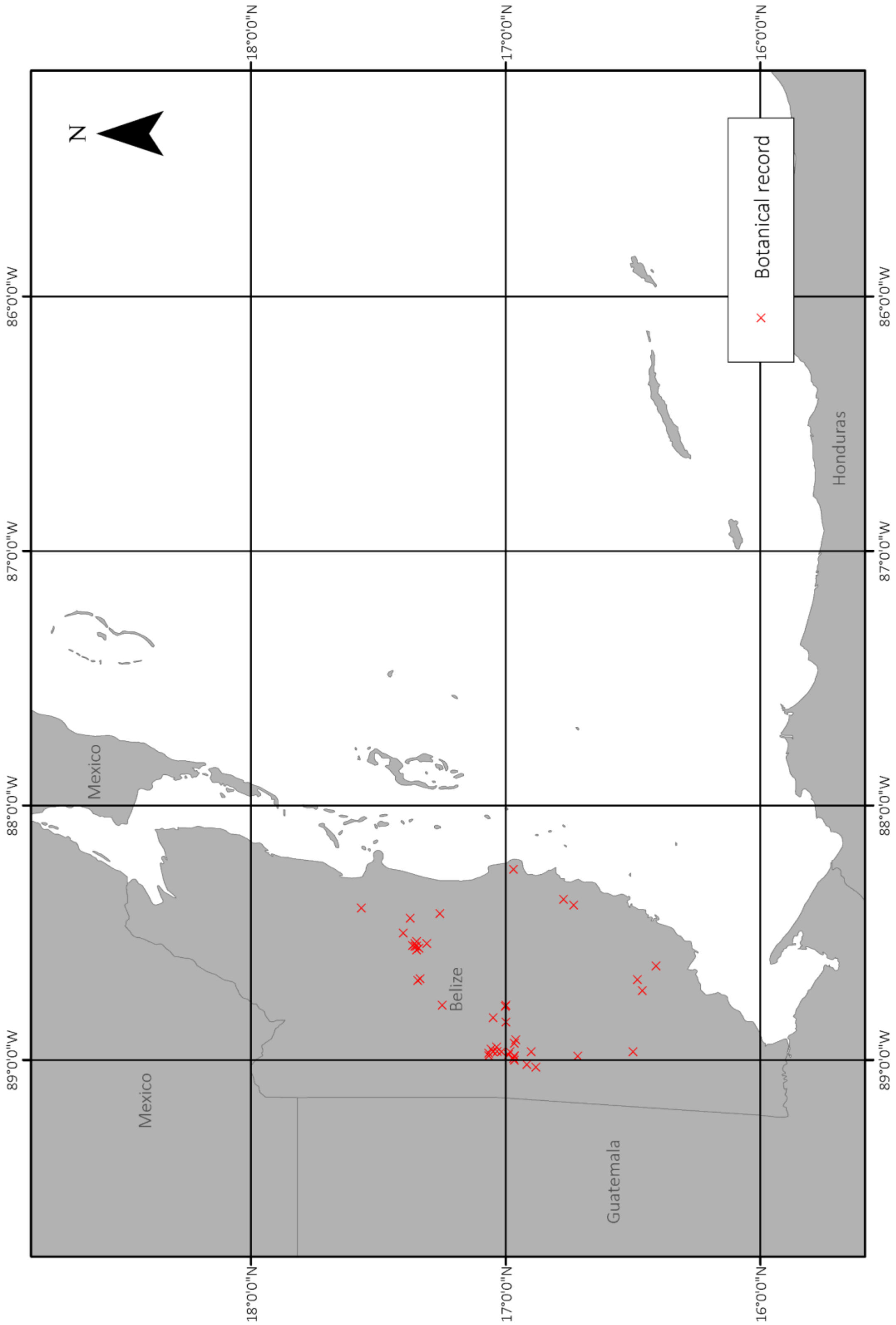


Figure 1. Distribution (dot) map for *Hypericum terrae-firmae* – placed in the Black Star category.

Figure 2. Distribution map for *Calliandra belizensis* – placed in the Gold Star category.

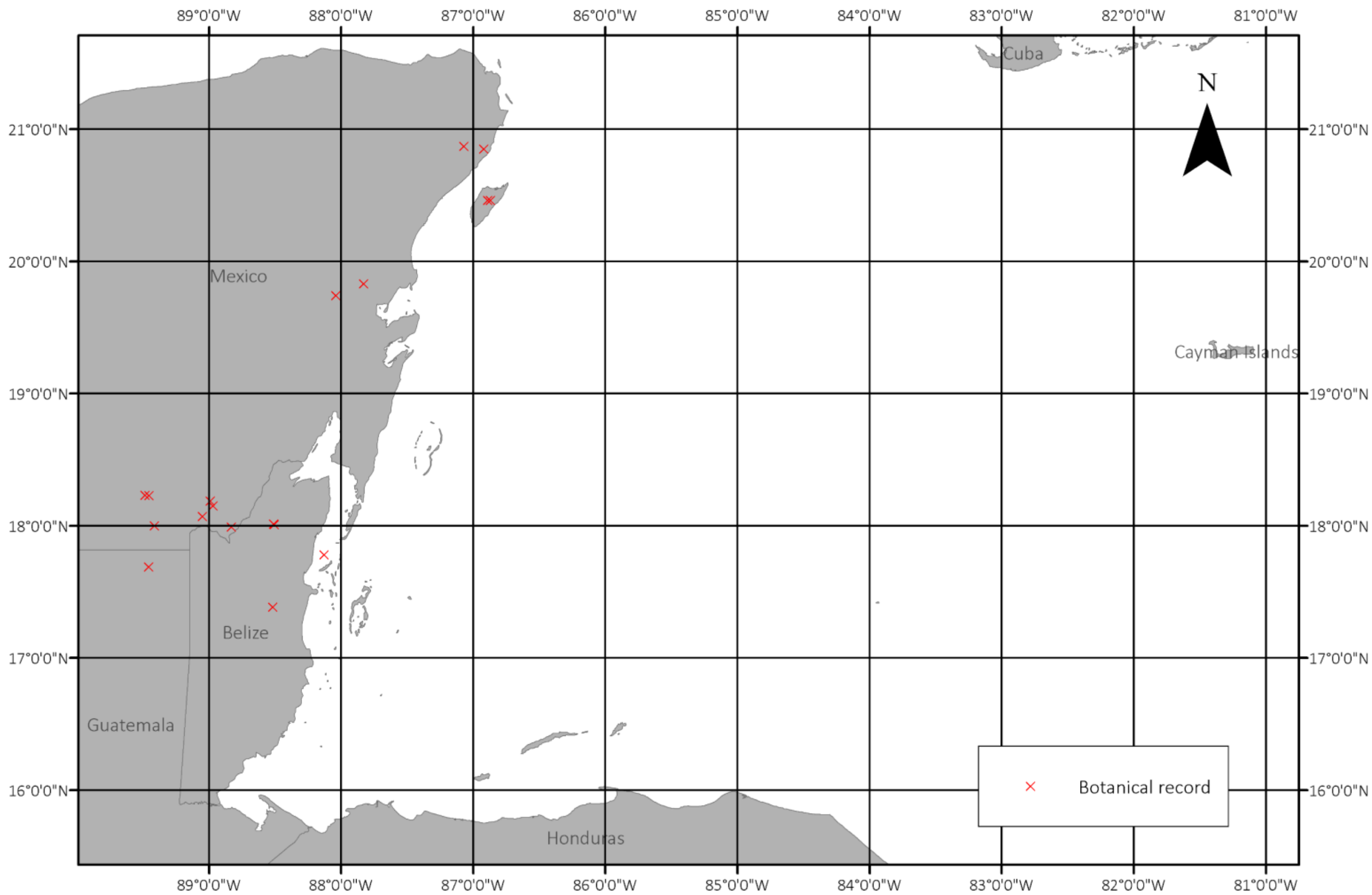


Figure 3. Distribution map for *Vitex gaumeri* – placed in the Blue Star category.

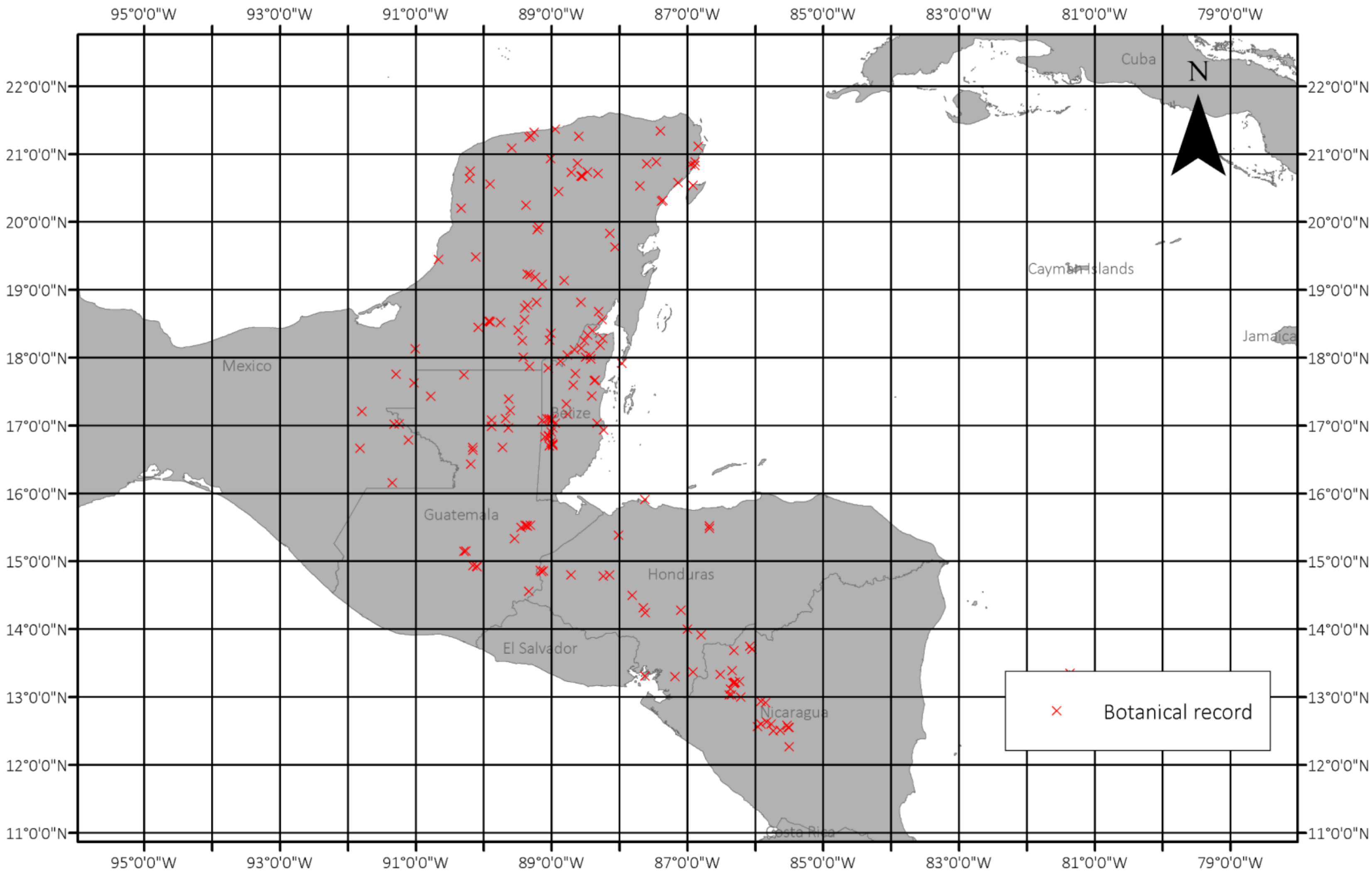
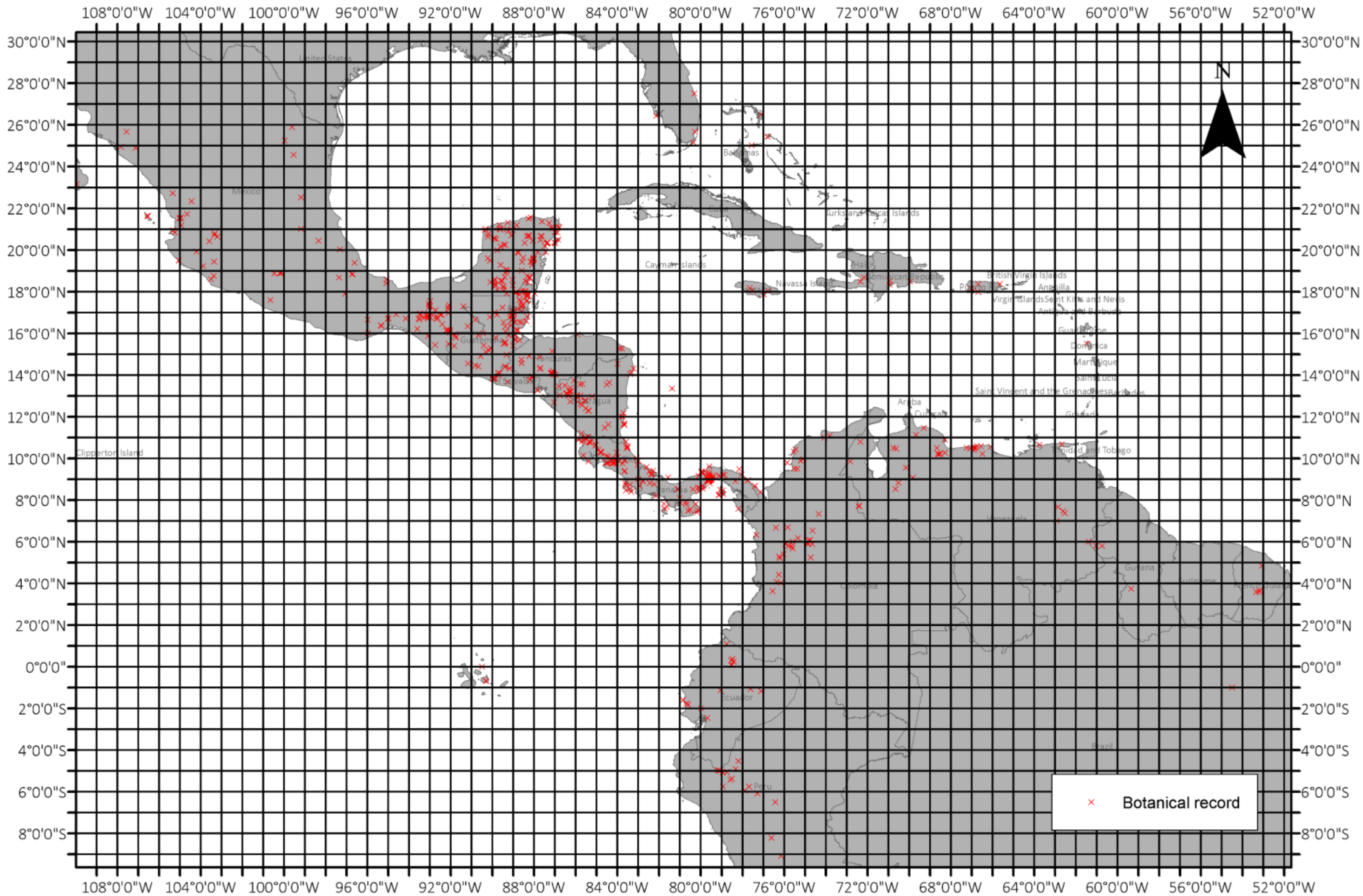


Figure 4. Distribution map for *Chiococca alba* – placed in the Green Star category.



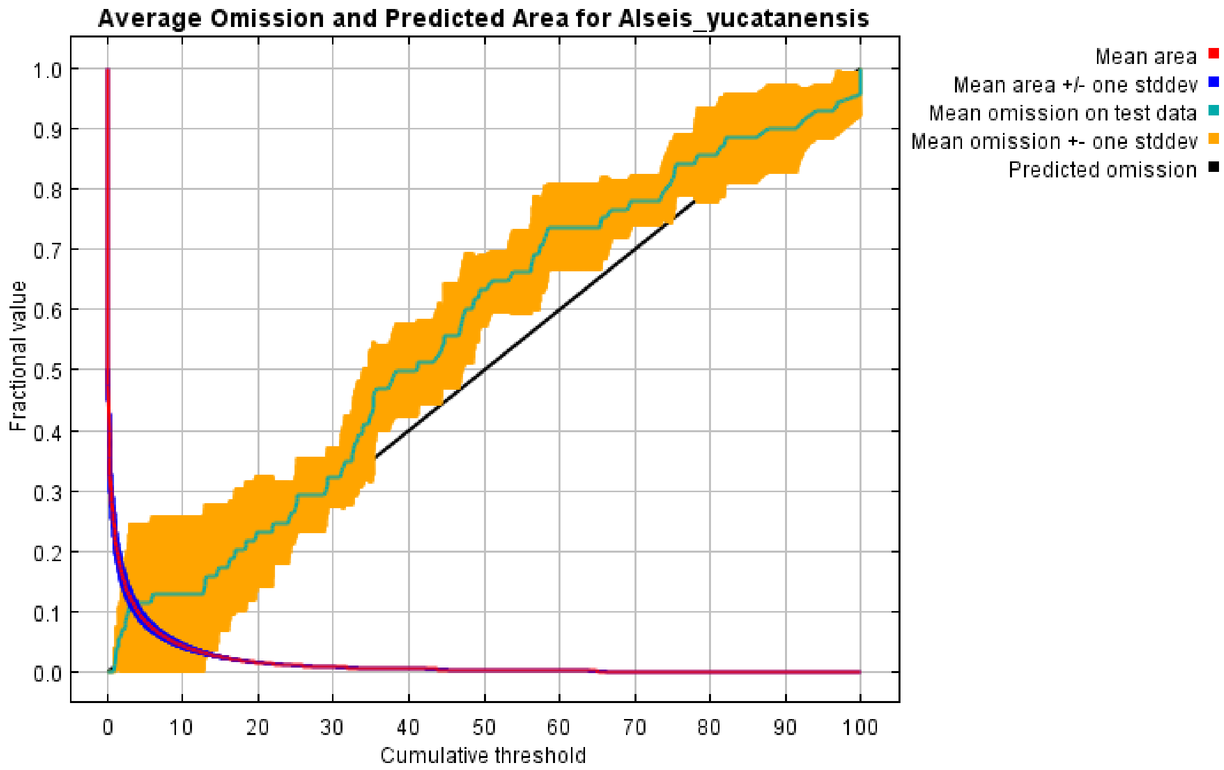
APPENDIX IV

Examples of analyses from a Maxent model for *Alseis yucatanensis*

Replication allows Maxent to run a series of analyses that assist in evaluating the predictive performance and ecological plausibility of each model, and in determining which variables are most important to the model. All results in this document show values for the average of 5 replicate runs.

1. Analysis of omission / commission

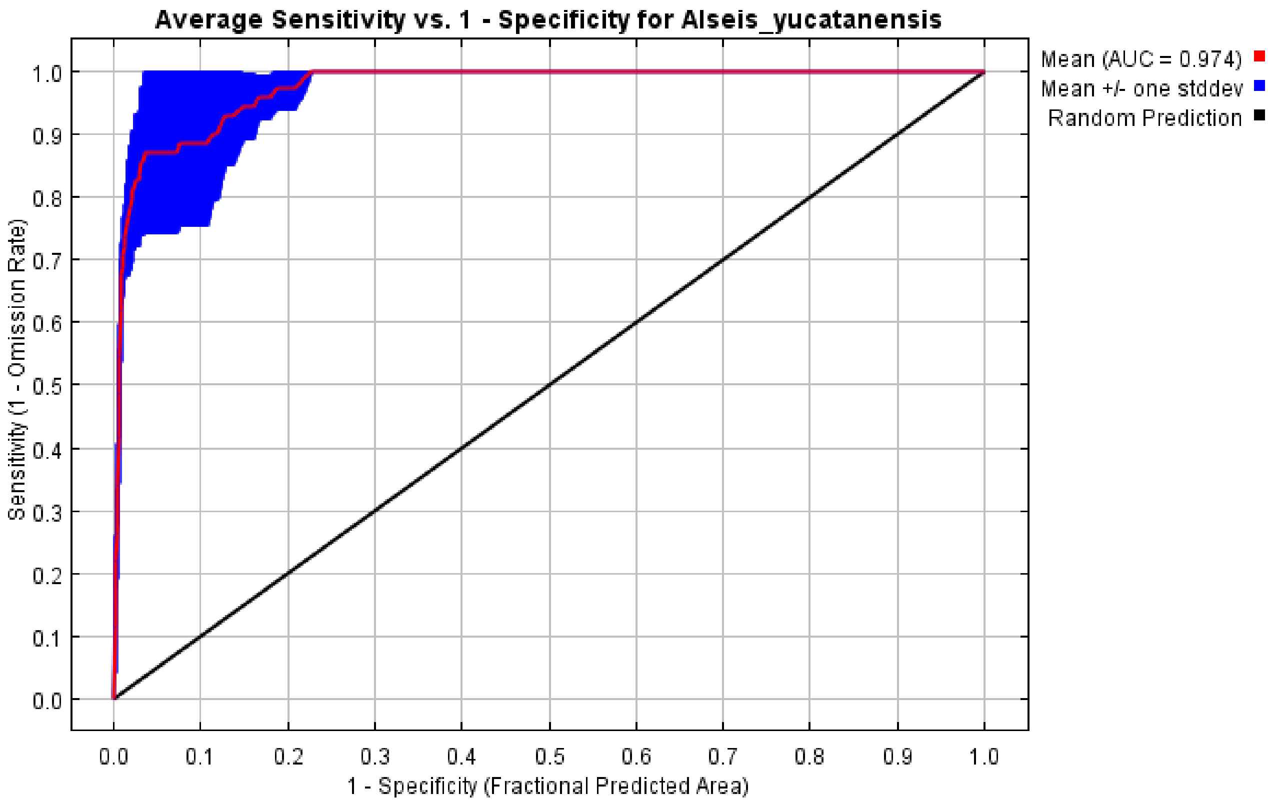
Omission and commission relate to the two types of prediction error that can occur with presence/absence models. Omission errors are false negatives, whereby a pixel that corresponds to a known occurrence point is not predicted as suitable habitat. Commission errors are false positives, whereby a pixel that corresponds to a known absence point is predicted as suitable habitat. A low omission rate indicates good predictive performance. Commission error rates should be treated with caution if there are no absence data. The graph below shows the mean (of the 5 replicate runs) omission rate for the test data, and the mean predicted area as a function of the cumulative threshold.



2. Sensitivity versus specificity

The graph below displays the receiver operating characteristic (ROC) curve for the same model (the average of the 5 replicate runs). Sensitivity depicts how well the model predicts a true presence (the ‘true positive rate’). Specificity depicts how well the model predicts a true absence (the ‘true negative rate’). For these analyses, Maxent treats background points as pseudo-absences (but not for fitting the model).

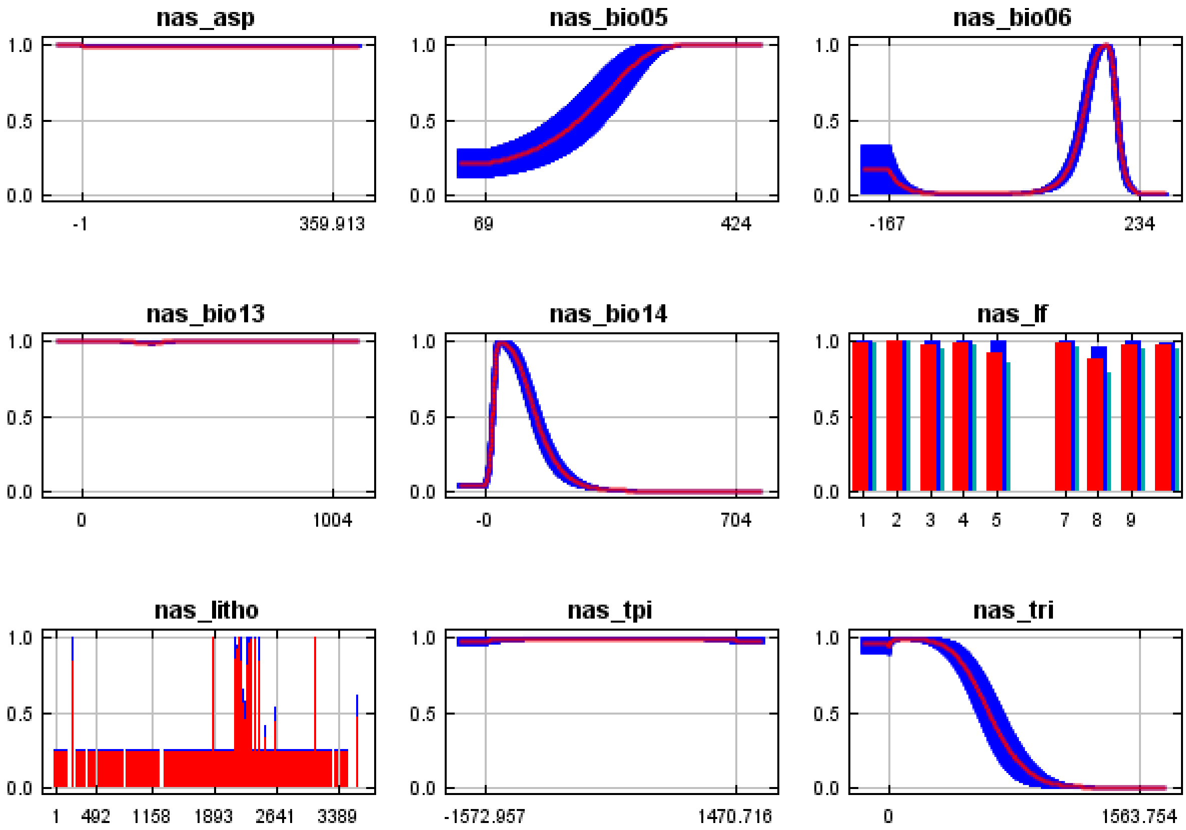
The average test Area under the Curve (AUC) value across the 5 replicate runs is 0.974. An AUC value close to 1 indicates excellent predictive performance. The closer the ROC curve follows the y-axis, the larger the area under the curve, and thus the more accurate the model. A value of 0.5 or less represents a prediction that is no better than random.



3. Species response curves

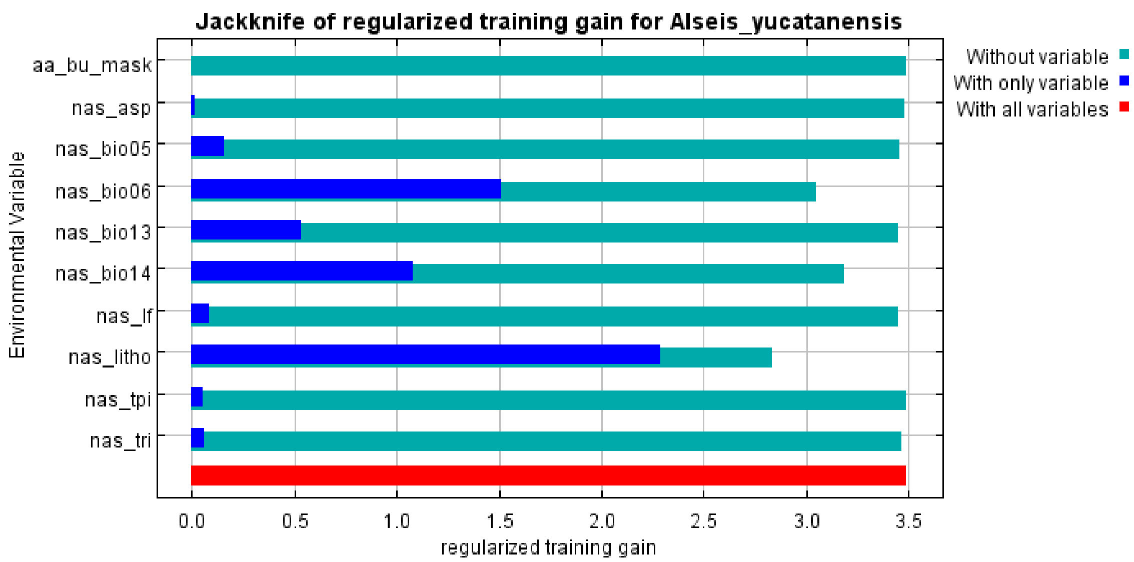
Response curves show how the predicted probability of presence changes as each environmental variable is varied. Graphs below show the marginal effect of changing one variable at a time (with all other variables kept at their average sample value). Graphs show the average response of the 5 replicate runs (in red) and variation across the models (+/- one standard deviation) in blue.

Variables shown in the graphs are as follows (‘nas’ is simply a prefix referring to the dataset used): asp (aspect), bio5 (maximum temperature of warmest month), bio6 (minimum temperature of coldest month), bio13 (precipitation of wettest month), bio14 (precipitation of driest month) lf (landform), litho (lithology), tpi (topographic position), tri (terrain ruggedness).

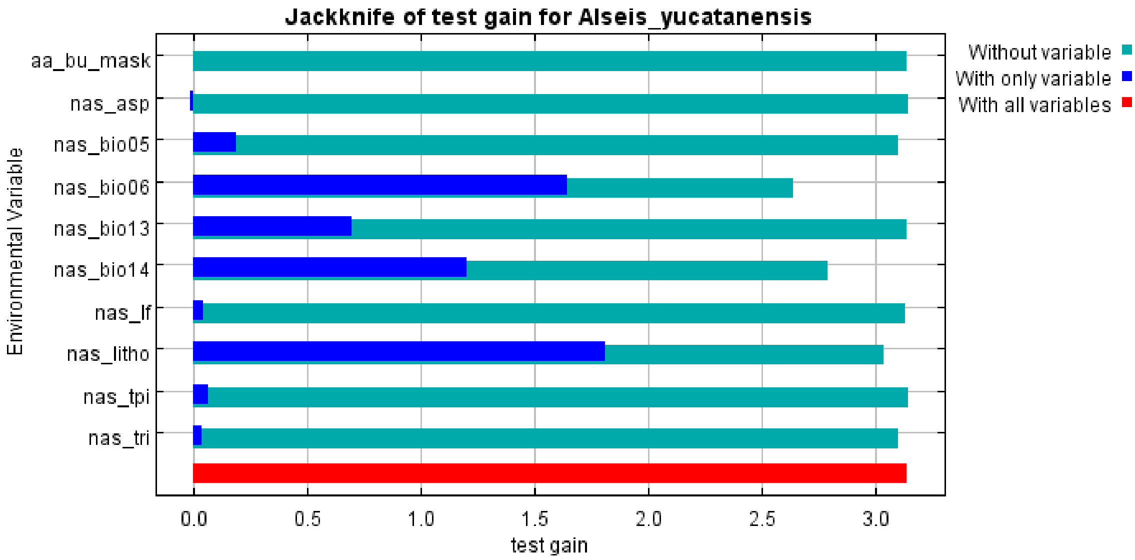


4. Analysis of variable contributions

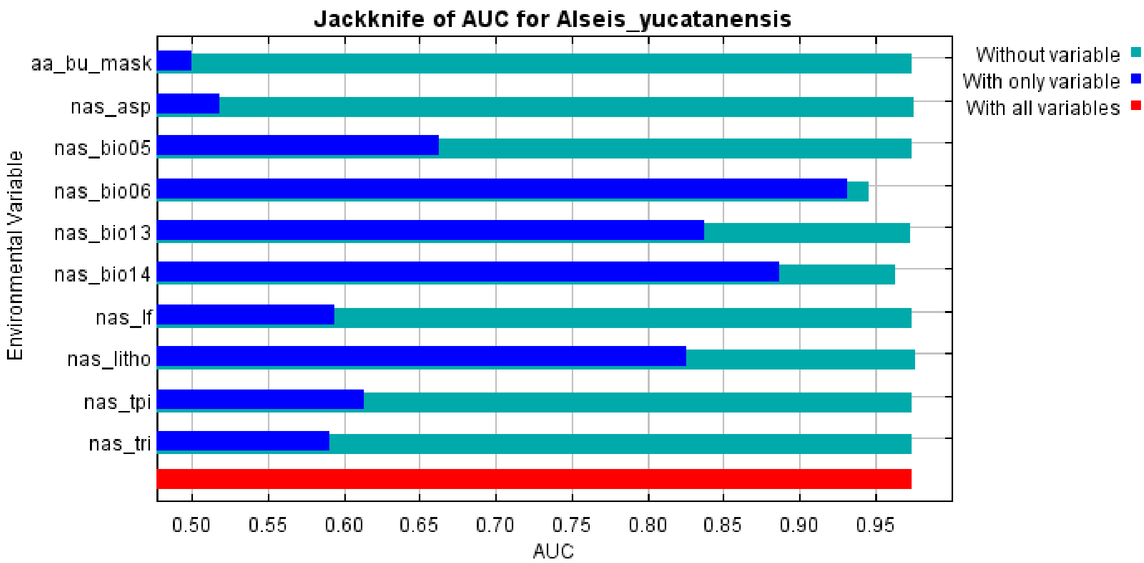
The graph below is the result of the jackknife test of variable importance for training data. Important variables are those that cause the greatest increase in gain when used in isolation, and the greatest decrease in gain when removed from the model. ‘Gain’ is closely related to deviance; a measure of goodness of fit used in general additive and general linear models.



The next graph is also a jackknife test of variable importance, but shows the gain for the test data rather than the training data.



The third jackknife test uses the AUC value from the test data to measure variable importance.



APPENDIX V

Species lists for 30 RBS plots

For data collection methods, see Hawthorne & Marshall, 2015. Data were collected in the Toledo District of Belize from Jan - April 2016, as part of this D.Phil. research.

Where species could not be confidently identified in the field, vouchers were collected and examined (in person) against material at the Forest Department herbarium (BRH) in Belize, at the Royal Botanic Garden Edinburgh (E), and at the Natural History Museum London (BM). Names reflect those in the checklist of the vascular plants of Belize (see Appendix II). Species determinations by Gail Stott, with assistance from Steven Brewer (in Belize), Alison Paul (Natural History Museum London), Zoë Goodwin, Stuart Linsday, Steven Sylvester and Mary Gibby (Royal Botanic Garden Edinburgh).

Fertile material will be deposited at E with duplicates sent to BRH, MO and NHM in 2019.

Sample name	Voucher	Family	Det status	Genus	Species
LIM01	T 00001RBS	Apocynaceae	OK	Aspidosperma	spruceanum
LIM01	T 00002RBS	Araliaceae	OK	Dendropanax	arboreus
LIM01	T 00003RBS	Olacaceae	OK	Heisteria	media
LIM01	T 00004RBS	Fabaceae - Caesalpinioideae	INDET	Macrolobium	
LIM01	T 00005RBS	Fabaceae - Caesalpinioideae	OK	Bauhinia	divaricata
LIM01	T 00006RBS	Calophyllaceae	OK	Calophyllum	brasiliense
LIM01	T 00007RBS	Urticaceae	OK	Cecropia	peltata
LIM01	T 00008RBS	Ebenaceae	OK	Diospyros	digyna
LIM01	T 00009RBS	Putranjivaceae	OK	Drypetes	brownii
LIM01	T 00010RBS	Sapotaceae	OK	Pouteria	durlandii
LIM01	T 00011RBS	Malvaceae	OK	Quararibea	funebris
LIM01	T 00012RBS	Moraceae	OK	Brosimum	alicastrum
LIM01	T 00013RBS	Polygonaceae	OK	Coccoloba	diversifolia
LIM01	T 00014RBS	Clusiaceae	OK	Garcinia	intermedia
LIM01	T 00015RBS	Annonaceae	OK	Oxandra	belizensis
LIM01	T 00016RBS	Myrtaceae	OK	Pimenta	dioica
LIM01	T 00017RBS	Sapotaceae	OK	Pouteria	reticulata
LIM01	T 00018RBS	Moraceae	OK	Pseudolmedia	spuria
LIM01	T 00019RBS	Fabaceae - Faboideae	OK	Lonchocarpus	guatemalensis
LIM01	T 00020RBS	Fabaceae - Mimosoideae	OK	Lysiloma	latisiliqua
LIM01	T 00021RBS	Anacardiaceae	OK	Metopium	brownei
LIM01	T 00022RBS	Sapotaceae	OK	Pouteria	amygdalina
LIM01	T 00023RBS	Anacardiaceae	OK	Astronium	graveolens
LIM01	F 00001RBS	Pteridaceae	OK	Adiantum	tetraphyllum
LIM01	F 00002RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM01	F 00003RBS		INDET		
LIM01	F 00004RBS	Thelypteridaceae	OK	Thelypteris	ghiesbreghtii
LIM01	F 00005RBS	Pteridaceae	OK	Adiantum	capillus-veneris
LIM01	F 00006RBS		INDET		
LIM01	F 00007RBS	Thelypteridaceae	OK	Thelypteris	ghiesbreghtii
LIM01	P 00001RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti

LIM01	P 00002RBS	Arecaceae	OK	Sabal	mauritiiformis
LIM01	P 00003RBS	Arecaceae	OK	Attalea	cohune
LIM01	P 00004RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM01	P 00005RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
LIM01	P 00006RBS	Arecaceae	OK	Cryosophila	stauracantha
LIM01	V 00001RBS	Bignoniaceae	OK	Amphilophium	paniculatum
LIM01	V 00002RBS	Araceae	CF	Syngonium	podophyllum
LIM01	V 00003RBS	Bignoniaceae	CF	Stizophyllum	riparium
LIM01	V 00004RBS	Araceae	CF	Philodendron	radiatum
LIM01	V 00005RBS		INDET		
LIM01	V 00006RBS	Sapindaceae	OK	Cardiospermum	grandiflorum
LIM01	V 00007RBS	Araceae	CF	Anthurium	pentaphyllum
LIM01	V 00008RBS	Araceae	CF	Anthurium	schlechtendalii
LIM01	V 00009RBS	Araceae	CF	Philodendron	hederaceum
LIM01	V 00010RBS	Araceae	CF	Spathiphyllum	blandum
LIM01	V 00011RBS	Araceae	CF	Spathiphyllum	blandum
LIM01	V 00012RBS	Bignoniaceae	CF	Stizophyllum	riparium
LIM01	V 00013RBS	Fabaceae - Caesalpinioideae	CF	Bauhinia	divaricata
LIM01	SH 00001RBS	Theophrastaceae	OK	Deherainia	smaragdina
LIM01	T 00000RBS	Myristicaceae	OK	Compsoneura	mexicana
LIM01	T 00000RBS	Piperaceae	OK	Piper	psilorhachis
LIM01	V 00014RBS	Dioscoreaceae	OK	Dioscorea	bartlettii
LIM01	T 00000RBS	Acanthaceae	OK	Odontonema	hondurense
LIM01	T 00000RBS	Rubiaceae	OK	Faramea	occidentalis
LIM01	SH 00001RBS	Bignoniaceae	OK	Mansoa	kerere
LIM01	V 00013RBS	Malpighiaceae	CF	Stigmaphyllon	ellipticum
LIM01	V 00004RBS	Asteraceae	INDET	Mikania	
LIM02	T 00001RBS	Rutaceae	OK	Zanthoxylum	ekmanii
LIM02	T 00002RBS	Melastomataceae	OK	Miconia	hondurensis
LIM02	T 00003RBS	Euphorbiaceae	OK	Alchorneopsis	floribunda
LIM02	T 00004RBS	Fabaceae - Caesalpinioideae	OK	Schizolobium	parahyba
LIM02	T 00005RBS	Meliaceae	CF	Guarea	macrophylla
LIM02	T 00006RBS	Urticaceae	OK	Cecropia	peltata
LIM02	T 00007RBS	Fabaceae	OK	Senegalia	polyphylla
LIM02	T 00008RBS	Rutaceae	OK	Zanthoxylum	ekmanii
LIM02	T 00009RBS	Araliaceae	OK	Dendropanax	arboreum
LIM02	T 00010RBS	Salicaceae	CF	Casearia	arborea
LIM02	T 00011RBS	Malvaceae	OK	Hampea	trilobata
LIM02	T 00012RBS	Euphorbiaceae	OK	Alchornea	latifolia
LIM02	T 00013RBS	Urticaceae	OK	Cecropia	obtusifolia
LIM02	T 00014RBS	Boraginaceae	CF	Cordia	diversifolia
LIM02	T 00015RBS	Fabaceae - Mimosoideae	CF	Inga	sapindoides
LIM02	T 00016RBS	Myristicaceae	OK	Virola	koschnyi
LIM02	T 00017RBS	Malvaceae	OK	Trichospermum	grewiifolium
LIM02	T 00018RBS	Malvaceae	OK	Guazuma	ulmifolia
LIM02	T 00019RBS	Anacardiaceae	OK	Spondias	radlkoferi
LIM02	T 00020RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense

LIM02	T 00021RBS	Burseraceae	OK	Protium	copal
LIM02	T 00022RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
LIM02	T 00023RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
LIM02	T 00024RBS	Olacaceae	OK	Heisteria	media
LIM02	P 00001RBS	Arecaceae	OK	Attalea	cohune
LIM02	P 00002RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM02	P 00003RBS	Arecaceae	OK	Bactris	mexicana
LIM02	P 00004RBS	Arecaceae	OK	Geonoma	deversa
LIM02	P 00005RBS	Arecaceae	OK	Chamaedorea	tepejilote
LIM02	P 00006RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
LIM02	P 00007RBS	Arecaceae	OK	Chamaedorea	oblongata
LIM02	F 00001RBS		INDET		
LIM02	F 00002RBS	Tectariaceae	OK	Tectaria	rivalis
LIM02	F 00003RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM02	F 00004RBS	Lygodiaceae	OK	Lygodium	heterodoxum
LIM02	F 00005RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM02	F 00006RBS	Thelypteridaceae	OK	Thelypteris	ghiesbreghtii
LIM02	F 00007RBS	Dryopteridaceae	OK	Ctenitis	excelsa
LIM02	F 00008RBS	Pteridaceae	CF	Adiantum	capillus-veneris
LIM02	F 00009RBS	Thelypteridaceae	OK	Thelypteris	biolleyi
LIM02	F 00010RBS	Lomariopsidaceae	OK	Cyclopeltis	semicordata
LIM02	F 00011RBS	Dryopteridaceae	CF	Polybotrya	polybotryoides
LIM02	F 00012RBS	Dryopteridaceae	OK	Ctenitis	excelsa
LIM02	V 00001RBS	Commelinaceae	CF	Commelina	rufipes
LIM02	V 00002RBS	Araceae	CF	Monstera	tuberculata
LIM02	V 00003RBS	Araceae	CF	Syngonium	angustatum
LIM02	V 00004RBS	Araceae	CF	Syngonium	angustatum
LIM02	V 00005RBS	Sapindaceae	CF	Serjania	mexicana
LIM02	V 00006RBS		INDET		
LIM02	V 00007RBS	Araceae	CF	Monstera	tuberculata
LIM02	V 00008RBS	Araceae	INDET		
LIM02	GLH00001RBS		INDET		
LIM02	GLH00002RBS	Araceae	CF	Spathiphyllum	blandum
LIM02	GLH00003RBS	Melastomataceae	CF	Clidemia	petiolaris
LIM02	GLH00004RBS	Marantaceae	OK	Maranta	arundinacea
LIM02	SH 00001RBS	Rubiaceae	INDET	Psychotria	
LIM02	GLH00005RBS	Acanthaceae	INDET		
LIM02	P 00008RBS	Arecaceae	OK	Desmoncus	orthacanthos
LIM02	GLH00006RBS	Costaceae	OK	Costus	pictus
LIM02	GLH00007RBS	Heliconiaceae	OK	Heliconia	aurantiaca
LIM02	GLH00008RBS	Araceae	CF	Spathiphyllum	blandum
LIM02	SH 00002RBS	Melastomataceae	OK	Clidemia	capitellata
LIM03	T 00001RBS		INDET		
LIM03	T 00002RBS	Araliaceae	OK	Dendropanax	arboreum
LIM03	T 00003RBS	Annonaceae	OK	Cymbopetalum	mayanum
LIM03	T 00004RBS	Sapindaceae	OK	Matayba	clavelligera
LIM03	T 00005RBS	Sapotaceae	OK	Chrysophyllum	venezuelanense

LIM03	T 00006RBS	Fabaceae - Mimosoideae	INDET	Inga	
LIM03	T 00007RBS	Annonaceae	OK	Cymbopetalum	mayanum
LIM03	T 00008RBS	Malvaceae	OK	Luehea	speciosa
LIM03	T 00009RBS	Malvaceae	OK	Quararibea	funebris
LIM03	T 00010RBS	Polygonaceae	OK	Coccoloba	diversifolia
LIM03	T 00011RBS	Urticaceae	OK	Myriocarpa	longipes
LIM03	T 00012RBS	Annonaceae	OK	Annona	liebmanniana
LIM03	T 00013RBS	Polygonaceae	OK	Coccoloba	tuerckheimii
LIM03	T 00014RBS	Anacardiaceae	OK	Astronium	graveolens
LIM03	T 00015RBS	Lauraceae	OK	Nectandra	lundellii
LIM03	T 00016RBS	Meliaceae	CF	Guarea	macrophylla
LIM03	T 00017RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
LIM03	T 00018RBS	Myristicaceae	OK	Virola	koschnyi
LIM03	T 00019RBS	Anacardiaceae	OK	Spondias	radlkoferi
LIM03	T 00020RBS	Rutaceae	OK	Zanthoxylum	ekmanii
LIM03	T 00021RBS	Fabaceae - Mimosoideae	INDET	Inga	
LIM03	T 00022RBS	Moraceae	INDET		
LIM03	T 00023RBS	Moraceae	OK	Brosimum	alicastrum
LIM03	T 00024RBS	Moraceae	INDET		
LIM03	T 00025RBS	Malvaceae	OK	Ceiba	pentandra
LIM03	T 00026RBS	Urticaceae	OK	Cecropia	peltata
LIM03	T 00027RBS	Burseraceae	OK	Protium	confusum
LIM03	T 00028RBS	Malvaceae	OK	Guazuma	ulmifolia
LIM03	P 00001RBS	Arecaceae	OK	Chamaedorea	tepejilote
LIM03	P 00002RBS	Arecaceae	OK	Attalea	cohune
LIM03	P 00003RBS	Arecaceae	OK	Chamaedorea	tepejilote
LIM03	P 00004RBS	Arecaceae	OK	Bactris	mexicana
LIM03	P 00005RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM03	P 00006RBS	Arecaceae	OK	Desmoncus	orthacanthos
LIM03	F 00001RBS	Tectariaceae	OK	Tectaria	rivalis
LIM03	F 00002RBS		INDET		
LIM03	F 00003RBS		INDET		
LIM03	F 00004RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM03	F 00005RBS	Tectariaceae	OK	Tectaria	mexicana
LIM03	F 00006RBS	Pteridaceae	OK	Adiantum	tetraphyllum
LIM03	GLH00001RBS	Araceae	OK	Spathiphyllum	blandum
LIM03	H 00002RBS	Orchidaceae	INDET		
LIM03	H 00003RBS	Costaceae	OK	Costus	pictus
LIM03	H 00004RBS	Acanthaceae	OK	Justicia	fimbriata
LIM03	H 00005RBS	Commelinaceae	INDET		
LIM03	V 00001RBS	Bignoniaceae	OK	Amphilophium	paniculatum
LIM03	V 00002RBS	Araceae	CF	Syngonium	macrophyllum
LIM03	V 00003RBS	Araceae	CF	Monstera	acuminata
LIM03	V 00004RBS	Araceae	CF	Monstera	acuminata
LIM03	V 00005RBS	Araceae	CF	Syngonium	podophyllum
LIM03	V 00006RBS	Araceae	CF	Monstera	acuminata
LIM03	V 00007RBS	Araceae	CF	Spathiphyllum	blandum

LIM03	V 00008RBS		INDET		
LIM03	P 00007RBS	Arecaceae	OK	Cryosophila	stauracantha
LIM03	F 00006RBS		INDET		
LIM03	H 00006RBS	Marantaceae	OK	Maranta	arundinacea
LIM03	F 00005RBS	Pteridaceae	OK	Pteris	altissima
LIM04	T 00001RBS	Moraceae	OK	Poulsenia	armata
LIM04	T 00023RBS	Fabaceae - Mimosoideae	OK	Inga	thibaudiana
LIM04	T 00002RBS	Combretaceae	OK	Terminalia	oblonga
LIM04	T 00003RBS	Lauraceae	OK	Nectandra	lundellii
LIM04	T 00004RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
LIM04	T 00005RBS	Malvaceae	OK	Quararibea	funebris
LIM04	T 00006RBS	Anacardiaceae	OK	Astronium	graveolens
LIM04	T 00007RBS	Ulmaceae	OK	Ampelocera	hottlei
LIM04	T 00008RBS	Olacaceae	OK	Heisteria	media
LIM04	T 00009RBS	Apocynaceae	OK	Aspidosperma	megalocarpon
LIM04	T 00010RBS		INDET		
LIM04	T 00011RBS	Fabaceae - Mimosoideae	CF	Inga	quaternata
LIM04	T 00012RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
LIM04	T 00013RBS	Malvaceae	OK	Guazuma	ulmifolia
LIM04	T 00014RBS	Fabaceae - Caesalpinioideae	OK	Schizolobium	parahyba
LIM04	T 00015RBS	Anacardiaceae	OK	Spondias	radlkoferi
LIM04	T 00016RBS	Moraceae	INDET	Ficus	
LIM04	T 00017RBS	Polygonaceae	OK	Coccoloba	tuerckheimii
LIM04	T 00018RBS		INDET		
LIM04	T 00020RBS	Moraceae	OK	Poulsenia	armata
LIM04	T 00021RBS	Meliaceae	CF	Guarea	macrophylla
LIM04	T 00022RBS	Malvaceae	OK	Trichospermum	grewiifolium
LIM04	T 00023RBS	Fabaceae - Mimosoideae	CF	Inga	thibaudiana
LIM04	T 00024RBS	Urticaceae	OK	Cecropia	peltata
LIM04	P 00001RBS	Arecaceae	OK	Attalea	cohune
LIM04	P 00002RBS	Arecaceae	OK	Chamaedorea	tepejilote
LIM04	P 00003RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM04	P 00004RBS	Arecaceae	OK	Bactris	mexicana
LIM04	P 00005RBS	Arecaceae	OK	Geonoma	deversa
LIM04	F 00001RBS	Lomariopsidaceae	OK	Lomariopsis	vestita
LIM04	F 00002RBS	Thelypteridaceae	OK	Thelypteris	ghiesbreghtii
LIM04	F 00003RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM04	F 00004RBS	Thelypteridaceae	OK	Thelypteris	ghiesbreghtii
LIM04	F 00005RBS		INDET		
LIM04	F 00006RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM04	F 00007RBS	Thelypteridaceae	OK	Thelypteris	ghiesbreghtii
LIM04	F 00008RBS	Lygodiaceae	INDET	Lygodium	
LIM04	F 00009RBS	Pteridaceae	CF	Adiantum	capillus-veneris
LIM04	F 00010RBS	Tectariaceae	OK	Tectaria	rivalis
LIM04	SH 00001RBS	Piperaceae	OK	Piper	jacquemontianum
LIM04	SH 00002RBS	Urticaceae	OK	Myriocarpa	longipes
LIM04	SH 00003RBS	Piperaceae	OK	Piper	psilorhachis

LIM04	SH 00004RBS	Urticaceae	OK	Myriocarpa	heterospicata
LIM04	GLH00001RBS	Acanthaceae	OK	Justicia	fimbriata
LIM04	GLH00002RBS	Marantaceae	CF	Pleiostachya	pruinosa
LIM04	GLH00003RBS	Piperaceae	OK	Piper	umbellatum
LIM04	GLH00004RBS	Costaceae	OK	Costus	pictus
LIM04	SH 00005RBS		INDET		
LIM04	V 00001RBS	Convolvulaceae	OK	Merremia	tuberosa
LIM04	V 00003RBS	Bignoniaceae	OK	Arrabidaea	chica
LIM04	T 00001RBS	Fabaceae - Mimosoideae	OK	Inga	acrocephala
LIM04	V 00002RBS	Dioscoreaceae	OK	Dioscorea	composita
LIM05	T 00001RBS	Sapotaceae	OK	Manilkara	chicle
LIM05	T 00002RBS	Moraceae	INDET		
LIM05	T 00003RBS	Rutaceae	OK	Zanthoxylum	ekmanii
LIM05	T 00004RBS	Melastomataceae	OK	Mouriri	myrtilloides
LIM05	T 00005RBS	Moraceae	OK	Pseudolmedia	glabrata
LIM05	T 00006RBS	Moraceae	OK	Brosimum	alicastrum
LIM05	T 00007RBS	Rhizophoraceae	OK	Cassipourea	guianensis
LIM05	T 00008RBS	Lauraceae	OK	Licaria	areolata
LIM05	T 00009RBS	Meliaceae	OK	Trichilia	pallida
LIM05	T 00010RBS	Urticaceae	OK	Myriocarpa	longipes
LIM05	T 00011RBS		INDET		
LIM05	T 00012RBS	Piperaceae	OK	Piper	psilorhachis
LIM05	T 00013RBS	Rutaceae	OK	Zanthoxylum	juniperinum
LIM05	T 00014RBS	Salicaceae	OK	Casearia	sylvestris
LIM05	T 00015RBS	Moraceae	OK	Ficus	popenoei
LIM05	T 00016RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
LIM05	T 00017RBS	Fabaceae - Caesalpinioideae	OK	Schizolobium	parahyba
LIM05	T 00018RBS	Euphorbiaceae	OK	Croton	billbergianus
LIM05	T 00019RBS	Malvaceae	OK	Trichospermum	grewiifolium
LIM05	T 00020RBS	Olacaceae	OK	Heisteria	media
LIM05	T 00022RBS	Urticaceae	OK	Cecropia	peltata
LIM05	T 00023RBS		INDET		
LIM05	T 00024RBS	Fabaceae	OK	Senegalia	polyphylla
LIM05	T 00025RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
LIM05	T 00026RBS	Moraceae	INDET		
LIM05	T 00027RBS	Burseraceae	OK	Protium	confusum
LIM05	T 00028RBS	Fabaceae - Mimosoideae	CF	Inga	acrocephala
LIM05	T 00029RBS	Meliaceae	OK	Guarea	glabra
LIM05	T 00030RBS	Fabaceae - Mimosoideae	OK	Acacia	cookii
LIM05	T 00031RBS	Vochysiaceae	OK	Vochysia	hondurensis
LIM05	T 00032RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
LIM05	P 00001RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM05	P 00002RBS	Arecaceae	OK	Attalea	cohune
LIM05	P 00003RBS	Arecaceae	OK	Calyptrogyne	ghiesbreghtiana
LIM05	P 00004RBS	Arecaceae	OK	Geonoma	interrupta
LIM05	P 00005RBS	Arecaceae	OK	Chamaedorea	tepejilote
LIM05	P 00006RBS	Arecaceae	OK	Sabal	mauritiiformis

LIM05	P 00007RBS	Arecaceae	OK	Desmoncus	orthacanthos
LIM05	P 00008RBS	Arecaceae	OK	Bactris	mexicana
LIM05	F 00001RBS		INDET		
LIM05	F 00002RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM05	F 00003RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM05	F 00004RBS	Pteridaceae	OK	Adiantum	tetraphyllum
LIM05	F 00005RBS	Lygodiaceae	OK	Lygodium	venustum
LIM05	F 00006RBS	Thelypteridaceae	OK	Thelypteris	tetragona
LIM05	F 00007RBS	Lomariopsidaceae	OK	Lomariopsis	vestita
LIM05	H 00001RBS	Marantaceae	OK	Maranta	arundinacea
LIM05	H 00002RBS	Heliconiaceae	INDET	Heliconia	
LIM05	H 00003RBS	Costaceae	OK	Costus	pictus
LIM05	H 00004RBS		INDET		
LIM05	H 00005RBS	Acanthaceae	OK	Justicia	fimbriata
LIM05	V 00001RBS	Bignoniaceae	OK	Anemopaegma	chrysoleucum
LIM05	V 00002RBS	Bignoniaceae	OK	Lundia	puberula
LIM05	V 00003RBS	Bignoniaceae	OK	Anemopaegma	chrysoleucum
LIM05	V 00004RBS	Bignoniaceae	CF	Callichlamys	latifolia
LIM05	V 00005RBS	Araceae	INDET		
LIM05	V 00006RBS	Araceae	CF	Spathiphyllum	blandum
LIM05	V 00007RBS	Araceae	CF	Syngonium	angustatum
LIM05	V 00008RBS	Araceae	INDET	Syngonium	
LIM05	V 00009RBS	Araceae	CF	Philodendron	radiatum
LIM05	T 00000RBS	Rubiaceae	OK	Bertiera	guianensis
LIM06	T 00001RBS	Actinidiaceae	OK	Saurauia	yasicae
LIM06	T 00003RBS	Malvaceae	OK	Ceiba	pentandra
LIM06	T 00004RBS	Combretaceae	OK	Terminalia	oblonga
LIM06	T 00005RBS	Euphorbiaceae	OK	Alchornea	latifolia
LIM06	T 00006RBS	Polygonaceae	OK	Coccoloba	tuerckheimii
LIM06	T 00007RBS	Lauraceae	CF	Ocotea	effusa
LIM06	T 00008RBS	Melastomataceae	INDET	Miconia	
LIM06	T 00009RBS	Combretaceae	OK	Terminalia	amazonia
LIM06	T 00010RBS	Malvaceae	OK	Guazuma	ulmifolia
LIM06	T 00011RBS	Elaeocarpaceae	OK	Sloanea	schippii
LIM06	T 00012RBS	Elaeocarpaceae	OK	Sloanea	schippii
LIM06	T 00013RBS	Bignoniaceae	OK	Tabebuia	rosea
LIM06	T 00014RBS	Araliaceae	OK	Dendropanax	arboreus
LIM06	T 00015RBS	Meliaceae	OK	Guarea	glabra
LIM06	T 00016RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
LIM06	T 00017RBS	Sapotaceae	OK	Pouteria	izabalensis
LIM06	T 00018RBS	Melastomataceae	OK	Miconia	impetiolaris
LIM06	T 00019RBS	Fabaceae - Faboideae	OK	Vatairea	lundellii
LIM06	T 00020RBS	Burseraceae	OK	Protium	multiramiflorum
LIM06	T 00021RBS		INDET		
LIM06	T 00022RBS	Moraceae	OK	Ficus	insipida
LIM06	T 00023RBS	Annonaceae	OK	Cymbopetalum	mayanum
LIM06	T 00024RBS	Malvaceae	OK	Ceiba	pentandra

LIM06	T 00025RBS	Anacardiaceae	OK	Spondias	radlkoferi
LIM06	T 00026RBS	Boraginaceae	OK	Cordia	diversifolia
LIM06	T 00027RBS	Combretaceae	OK	Terminalia	oblonga
LIM06	T 00028RBS	Combretaceae	OK	Terminalia	amazonia
LIM06	T 00029RBS	Sapotaceae	OK	Pouteria	durlandii
LIM06	P 00001RBS	Arecaceae	OK	Chamaedorea	neurochlamys
LIM06	P 00002RBS	Arecaceae	OK	Bactris	mexicana
LIM06	P 00003RBS	Arecaceae	CF	Desmoncus	orthacanthos
LIM06	P 00004RBS	Arecaceae	CF	Calyptrogyne	ghiesbreghtiana
LIM06	P 00005RBS	Arecaceae	OK	Sabal	mauritiiformis
LIM06	P 00006RBS	Arecaceae	OK	Bactris	mexicana
LIM06	P 00007RBS	Arecaceae	OK	Cryosophila	stauracantha
LIM06	P 00008RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM06	P 00009RBS	Arecaceae	OK	Attalea	cohune
LIM06	P 00010RBS	Arecaceae	OK	Chamaedorea	tepejilote
LIM06	F 00001RBS		INDET		
LIM06	F 00002RBS	Dryopteridaceae	OK	Bolbitis	serratifolia
LIM06	F 00003RBS	Dryopteridaceae	OK	Polybotrya	caudata
LIM06	F 00004RBS	Lygodiaceae	OK	Lygodium	heterodoxum
LIM06	F 00005RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM06	F 00006RBS	Pteridaceae	OK	Adiantum	macrophyllum
LIM06	F 00007RBS		INDET		
LIM06	V 00001RBS	Bignoniaceae	OK	Anemopaegma	chrysoleucum
LIM06	V 00002RBS	Araceae	CF	Anthurium	scandens
LIM06	V 00003RBS	Dilleniaceae	OK	Davilla	nitida
LIM06	V 00004RBS	Pteridaceae	OK	Anetium	citrifolium
LIM06	V 00005RBS	Araceae	OK	Spathiphyllum	blandum
LIM06	V 00006RBS	Araceae	CF	Monstera	acuminata
LIM06	V 00007RBS	Araceae	CF	Syngonium	podophyllum
LIM06	V 00008RBS	Araceae	OK	Philodendron	inaequilaterum
LIM06	V 00009RBS	Araceae	CF	Philodendron	hederaceum
LIM06	V 00010RBS		INDET		
LIM06	GLH00001RBS	Araceae	OK	Spathiphyllum	blandum
LIM06	GLH00002RBS	Zingiberaceae	OK	Renealmia	mexicana
LIM06	GLH00003RBS	Costaceae	INDET	Costus	
LIM06	SH 00001RBS	Urticaceae	OK	Urera	eggersii
LIM06	SH 00002RBS	Acanthaceae	OK	Justicia	fimbriata
LIM06	SH 00003RBS	Piperaceae	OK	Piper	jacquemontianum
LIM06	E 00004RBS	Araceae	CF	Philodendron	radiatum
LIM06	F 00008RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM06	E 00002RBS	Bromeliaceae	INDET		
LIM06	E 00003RBS	Bromeliaceae	INDET		
LIM07	T 00001RBS	Chrysobalanaceae	OK	Licania	hypoleuca
LIM07	T 00002RBS	Chrysobalanaceae	OK	Hirtella	guatemalensis
LIM07	T 00003RBS	Chrysobalanaceae	OK	Hirtella	guatemalensis
LIM07	T 00004RBS	Chrysobalanaceae	OK	Licania	sparsipilis
LIM07	T 00005RBS	Urticaceae	OK	Pourouma	bicolor

LIM07	T 00006RBS	Boraginaceae	OK	Cordia	diversifolia
LIM07	T 00007RBS	Euphorbiaceae	OK	Alchornea	latifolia
LIM07	T 00008RBS	Annonaceae	OK	Annona	liebmanniana
LIM07	T 00009RBS	Olacaceae	CF	Heisteria	media
LIM07	T 00010RBS	Vochysiaceae	OK	Vochysia	hondurensis
LIM07	T 00011RBS	Putranjivaceae	CF	Drypetes	brownii
LIM07	T 00012RBS	Anacardiaceae	OK	Tapirira	guianensis
LIM07	T 00013RBS		INDET		
LIM07	T 00014RBS	Fabaceae - Faboideae	OK	Myroxylon	balsamum
LIM07	T 00015RBS	Combretaceae	OK	Terminalia	amazonia
LIM07	T 00016RBS	Anacardiaceae	OK	Tapirira	guianensis
LIM07	T 00017RBS	Melastomataceae	OK	Miconia	impetiolaris
LIM07	T 00018RBS		INDET		
LIM07	T 00019RBS	Melastomataceae	OK	Miconia	chrysophylla
LIM07	T 00020RBS	Melastomataceae	OK	Miconia	elata
LIM07	T 00021RBS	Apocynaceae	OK	Lacmellea	standleyi
LIM07	P 00001RBS	Arecaceae	OK	Bactris	mexicana
LIM07	P 00002RBS	Arecaceae	OK	Chamaedorea	woodsoniana
LIM07	P 00003RBS	Arecaceae	OK	Euterpe	precatoria
LIM07	P 00004RBS	Arecaceae	CF	Geonoma	deversa
LIM07	P 00005RBS	Arecaceae	CF	Geonoma	deversa
LIM07	F 00001RBS	Cyatheaceae	OK	Cyathea	schiedeana
LIM07	F 00002RBS		INDET		
LIM07	F 00003RBS		INDET		
LIM07	F 00004RBS	Metaxyaceae	INDET		
LIM07	F 00005RBS	Marattiaceae	OK	Danaea	elliptica
LIM07	F 00006RBS	Hymenophyllaceae	OK	Trichomanes	pinnatum
LIM07	F 00007RBS	Pteridaceae	OK	Adiantum	tetraphyllum
LIM07	F 00008RBS	Dryopteridaceae	OK	Polybotrya	caudata
LIM07	V 00001RBS	Araceae	INDET	Syngonium	
LIM07	V 00002RBS	Sapindaceae	OK	Paullinia	glomerulosa
LIM07	V 00003RBS	Araceae	INDET		
LIM07	V 00004RBS	Araceae	CF	Anthurium	scandens
LIM07	V 00005RBS	Araceae	CF	Anthurium	scandens
LIM07	V 00006RBS	Bignoniaceae	OK	Lundia	puberula
LIM07	V 00007RBS	Araceae	INDET		
LIM07	V 00008RBS	Araceae	CF	Philodendron	hederaceum
LIM07	V 00009RBS	Araceae	INDET		
LIM07	V 00010RBS	Araceae	CF	Monstera	acuminata
LIM07	V 00011RBS	Melastomataceae	CF	Adelobotrys	adscendens
LIM07	V 00012RBS	Fabaceae - Faboideae	OK	Machaerium	isadelphum
LIM07	V 00013RBS	Dilleniaceae	OK	Davilla	nitida
LIM07	V 00014RBS	Fabaceae - Caesalpinioideae	OK	Bauhinia	divaricata
LIM07	GLH00007RBS	Rubiaceae	INDET	Psychotria	
LIM07	GLH00001RBS		INDET		
LIM07	GLH00002RBS	Araceae	CF	Spathiphyllum	blandum
LIM07	GLH00003RBS	Costaceae	INDET	Costus	

LIM07	GLH00004RBS	Zingiberaceae	OK	Renealmia	mexicana
LIM07	GLH00005RBS	Poaceae	OK	Olyra	latifolia
LIM07	SH 00001RBS	Rubiaceae	CF	Psychotria	poeppigiana
LIM07	GLH00006RBS	Rubiaceae	INDET	Psychotria	
LIM07	E 00001RBS	Araceae	INDET	Syngonium	
LIM07	E 00002RBS	Araceae	INDET		
LIM07	F 00001RBS	Dryopteridaceae	CF	Elaphoglossum	guatemalense
LIM08	T 00001RBS	Sapotaceae	OK	Pouteria	reticulata
LIM08	T 00002RBS	Moraceae	OK	Pseudolmedia	spuria
LIM08	T 00003RBS	Malvaceae	OK	Pseudobombax	ellipticoideum
LIM08	T 00004RBS	Myrtaceae	INDET	Eugenia	
LIM08	T 00005RBS	Burseraceae	OK	Protium	confusum
LIM08	T 00006RBS	Salicaceae	OK	Casearia	nitida
LIM08	T 00007RBS	Burseraceae	OK	Protium	confusum
LIM08	T 00008RBS	Burseraceae	OK	Protium	confusum
LIM08	T 00009RBS	Olacaceae	OK	Schoepfia	schreberi
LIM08	T 00010RBS	Polygonaceae	OK	Coccoloba	diversifolia
LIM08	T 00011RBS		INDET		
LIM08	T 00012RBS	Rubiaceae	OK	Stenostomum	lucidum
LIM08	T 00013RBS	Malvaceae	OK	Heliocarpus	americanus
LIM08	T 00015RBS	Moraceae	OK	Pseudolmedia	spuria
LIM08	T 00016RBS	Apocynaceae	OK	Aspidosperma	spruceanum
LIM08	T 00017RBS	Apocynaceae	OK	Aspidosperma	megalocarpon
LIM08	T 00018RBS	Burseraceae	OK	Protium	confusum
LIM08	T 00019RBS	Salicaceae	OK	Zuelania	guidonia
LIM08	T 00020RBS	Urticaceae	CF	Coussapoa	oligocephala
LIM08	T 00021RBS	Myristicaceae	OK	Virola	koschnyi
LIM08	T 00022RBS	Urticaceae	OK	Cecropia	obtusifolia
LIM08	P 00001RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
LIM08	P 00002RBS	Arecaceae	OK	Cryosophila	stauracantha
LIM08	P 00003RBS	Arecaceae	OK	Sabal	mauritiiformis
LIM08	P 00004RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
LIM08	P 00005RBS	Arecaceae	OK	Chamaedorea	neurochlamys
LIM08	F 00001RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
LIM08	F 00002RBS	Polypodiaceae	OK	Niphidium	crassifolium
LIM08	GLH00001RBS	Araceae	INDET	Syngonium	
LIM08	GLH00002RBS	Araceae	CF	Anthurium	pentaphyllum
LIM08	GLH00003RBS	Araceae	CF	Anthurium	verapazense
LIM08	GLH00004RBS	Moraceae	OK	Dorstenia	lindeniana
LIM08	GLH00005RBS	Orchidaceae	INDET		
LIM08	GLH00006RBS	Piperaceae	OK	Peperomia	obtusifolia
LIM08	V 00001RBS	Dilleniaceae	OK	Tetracera	volubilis
LIM08	V 00002RBS	Poaceae	INDET		
LIM08	V 00003RBS	Araceae	CF	Philodendron	hederaceum
LIM08	V 00004RBS	Araceae	CF	Syngonium	podophyllum
LIM08	V 00005RBS	Bignoniaceae	OK	Macfadyena	uncata
LIM08	V 00006RBS	Vitaceae	OK	Cissus	biformifolia

LIM08	V 00007RBS	Sapindaceae	CF	Serjania	mexicana
LIM08	SH 00001RBS	Piperaceae	OK	Piper	aduncum
LIM08	SH 00002RBS	Asteraceae	OK	Critonia	lanicaulis
LIM08	SH 00003RBS	Urticaceae	INDET		
LIM08	SH 00004RBS	Piperaceae	OK	Piper	yucatanense
LIM08	E 00001RBS	Araceae	CF	Philodendron	radiatum
LIM08	T 00010RBS	Urticaceae	OK	Coussapoa	oligocephala
LIM09	T 00002RBS	Boraginaceae	OK	Cordia	diversifolia
LIM09	T 00001RBS	Moraceae	OK	Pseudolmedia	spuria
LIM09	T 00002RBS	Sapotaceae	OK	Manilkara	chicle
LIM09	T 00003RBS	Putranjivaceae	OK	Drypetes	brownii
LIM09	T 00004RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
LIM09	T 00005RBS	Fabaceae - Mimosoideae	OK	Acacia	cookii
LIM09	T 00006RBS	Lauraceae	OK	Licaria	areolata
LIM09	T 00007RBS	Boraginaceae	OK	Cordia	diversifolia
LIM09	T 00008RBS	Sapotaceae	OK	Manilkara	zapota
LIM09	T 00009RBS	Vochysiaceae	OK	Vochysia	hondurensis
LIM09	T 00010RBS	Sapotaceae	OK	Pouteria	durlandii
LIM09	T 00011RBS	Chrysobalanaceae	OK	Licania	hypoleuca
LIM09	T 00012RBS	Anacardiaceae	OK	Metopium	brownei
LIM09	T 00013RBS	Rhamnaceae	CF	Krugiodendron	ferreum
LIM09	T 00014RBS	Malvaceae	OK	Heliocarpus	americanus
LIM09	T 00015RBS	Apocynaceae	OK	Aspidosperma	megalocarpon
LIM09	T 00016RBS	Rhizophoraceae	OK	Cassipourea	guianensis
LIM09	T 00017RBS	Sapotaceae	OK	Pouteria	reticulata
LIM09	T 00018RBS	Fabaceae - Faboideae	OK	Lonchocarpus	punctatus
LIM09	T 00019RBS	Urticaceae	OK	Cecropia	obtusifolia
LIM09	P 00001RBS	Arecaceae	OK	Cryosophila	stauracantha
LIM09	P 00002RBS	Arecaceae	OK	Sabal	mauritiiformis
LIM09	P 00003RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
LIM09	P 00004RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM09	P 00005RBS	Arecaceae	OK	Bactris	mexicana
LIM09	P 00006RBS	Arecaceae	OK	Chamaedorea	neurochlamys
LIM09	P 00007RBS	Arecaceae	OK	Desmoncus	orthacanthos
LIM09	F 00001RBS	Pteridaceae	INDET	Adiantum	
LIM09	F 00002RBS	Pteridaceae	CF	Adiantum	tetraphyllum
LIM09	F 00003RBS	Lygodiaceae	OK	Lygodium	venustum
LIM09	F 00004RBS	Pteridaceae	CF	Pteris	altissima
LIM09	V 00001RBS	Bignoniaceae	OK	Macfadyena	uncata
LIM09	V 00002RBS	Araceae	CF	Anthurium	pentaphyllum
LIM09	V 00003RBS	Araceae	CF	Syngonium	podophyllum
LIM09	V 00004RBS	Bignoniaceae	OK	Macfadyena	uncata
LIM09	V 00005RBS	Araceae	OK	Anthurium	scandens
LIM09	V 00006RBS	Smilacaceae	OK	Smilax	mollis
LIM09	V 00007RBS	Sapindaceae	OK	Paullinia	costaricensis
LIM09	V 00008RBS	Araceae	CF	Monstera	tuberculata
LIM09	V 00009RBS	Bignoniaceae	OK	Lundia	puberula

LIM09	V 00010RBS	Bignoniaceae	CF	Stizophyllum	riparium
LIM09	V 00011RBS	Dilleniaceae	OK	Tetracera	volubilis
LIM09	V 00012RBS	Menispermaceae	OK	Abuta	steyermarkii
LIM09	GLH00001RBS	Piperaceae	INDET	Piper	
LIM09	GLH00002RBS	Costaceae	OK	Costus	pulverulentus
LIM09	GLH00003RBS	Moraceae	OK	Dorstenia	lindeniana
LIM09	GLH00004RBS	Orchidaceae	INDET		
LIM09	GLH00005RBS	Rubiaceae	INDET		
LIM09	SH 00001RBS	Piperaceae	OK	Piper	schippianum
LIM09	SH 00002RBS	Turneraceae	OK	Piriqueta	cistoides
LIM10	T 00001RBS	Meliaceae	OK	Guarea	glabra
LIM10	T 00002RBS	Anacardiaceae	OK	Spondias	radlkoferi
LIM10	T 00003RBS	Combretaceae	OK	Terminalia	amazonia
LIM10	T 00004RBS	Moraceae	OK	Poulsenia	armata
LIM10	T 00005RBS	Sapindaceae	OK	Matayba	clavelligera
LIM10	T 00006RBS	Chrysobalanaceae	OK	Hirtella	triandra
LIM10	T 00007RBS	Malvaceae	OK	Trichospermum	mexicanum
LIM10	T 00008RBS	Urticaceae	OK	Cecropia	obtusifolia
LIM10	T 00009RBS	Burseraceae	OK	Protium	copal
LIM10	T 00010RBS	Malvaceae	OK	Heliocarpus	americanus
LIM10	T 00011RBS	Fabaceae - Mimosoideae	OK	Acacia	cookii
LIM10	T 00012RBS	Malvaceae	OK	Quararibea	funebris
LIM10	T 00013RBS	Myristicaceae	OK	Compsoneura	mexicana
LIM10	T 00014RBS	Rutaceae	OK	Zanthoxylum	juniperinum
LIM10	T 00015RBS	Rubiaceae	OK	Morinda	panamensis
LIM10	T 00016RBS		INDET		
LIM10	T 00017RBS	Urticaceae	OK	Myriocarpa	longipes
LIM10	GLH00001RBS	Araceae	OK	Spathiphyllum	blandum
LIM10	GLH00002RBS	Marantaceae	OK	Maranta	arundinacea
LIM10	GLH00003RBS	Costaceae	INDET	Costus	
LIM10	GLH00004RBS	Heliconiaceae	OK	Heliconia	vaginalis
LIM10	GLH00005RBS	Araceae	CF	Syngonium	podophyllum
LIM10	GLH00006RBS	Araceae	INDET		
LIM10	GLH00007RBS	Heliconiaceae	INDET	Heliconia	
LIM10	GLH00008RBS	Cyclanthaceae	OK	Cyclanthus	bipartitus
LIM10	P 00001RBS	Arecaceae	OK	Calyptrogyne	ghiesbreghtiana
LIM10	P 00002RBS	Arecaceae	OK	Chamaedorea	neurochlamys
LIM10	P 00003RBS	Arecaceae	OK	Attalea	cohune
LIM10	P 00004RBS	Arecaceae	OK	Bactris	mexicana
LIM10	P 00005RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM10	P 00006RBS	Arecaceae	OK	Cryosophila	stauracantha
LIM10	F 00001RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM10	F 00002RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM10	F 00003RBS		INDET		
LIM10	F 00004RBS	Lygodiaceae	OK	Lygodium	heterodoxum
LIM10	F 00005RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM10	F 00006RBS	Pteridaceae	OK	Adiantum	capillus-veneris

LIM10	F 00007RBS	Pteridaceae	OK	Adiantum	tetraphyllum
LIM10	F 00008RBS	Lomariopsidaceae	OK	Nephrolepis	biserrata
LIM10	F 00009RBS	Thelypteridaceae	OK	Thelypteris	ghiesbreghtii
LIM10	F 00010RBS	Anemiaceae	OK	Anemia	adiantifolia
LIM10	V 00001RBS	Araceae	CF	Philodendron	inaequilaterum
LIM10	V 00002RBS	Araceae	CF	Monstera	acuminata
LIM10	V 00003RBS	Araceae	CF	Anthurium	scandens
LIM10	V 00004RBS	Araceae	CF	Anthurium	scandens
LIM10	V 00005RBS	Fabaceae - Caesalpinioideae	OK	Bauhinia	divaricata
LIM10	V 00006RBS	Bignoniaceae	OK	Lundia	puberula
LIM10	V 00007RBS	Sapindaceae	OK	Paullinia	costata
LIM10	V 00008RBS	Menispermaceae	OK	Abuta	steyermarkii
LIM10	V 00009RBS	Araceae	CF	Syngonium	podophyllum
LIM10	V 00010RBS	Dioscoreaceae	CF	Dioscorea	bartlettii
LIM10	V 00011RBS	Araceae	CF	Anthurium	scandens
LIM10	V 00012RBS		INDET		
LIM10	V 00013RBS	Bignoniaceae	OK	Amphilophium	paniculatum
LIM10	V 00014RBS	Araceae	CF	Anthurium	scandens
LIM10	V 00015RBS	Araceae	CF	Syngonium	podophyllum
LIM10	V 00016RBS	Araceae	CF	Anthurium	scandens
LIM10	E 00001RBS	Araceae	CF	Philodendron	radiatum
LIM11	T 00001RBS	Polygonaceae	OK	Coccoloba	tuerckheimii
LIM11	T 00002RBS	Sapotaceae	OK	Pouteria	izabalensis
LIM11	T 00003RBS		INDET		
LIM11	T 00004RBS	Lauraceae	OK	Ocotea	cernua
LIM11	T 00005RBS	Clusiaceae	OK	Garcinia	intermedia
LIM11	T 00006RBS	Euphorbiaceae	OK	Sapium	lateriflorum
LIM11	T 00007RBS	Monimiaceae	OK	Mollinedia	viridiflora
LIM11	T 00008RBS		INDET		
LIM11	T 00009RBS	Elaeocarpaceae	OK	Sloanea	schippii
LIM11	T 00010RBS	Rubiaceae	CF	Stenostomum	lucidum
LIM11	T 00011RBS	Rubiaceae	OK	Posoqueria	latifolia
LIM11	T 00012RBS	Melastomataceae	OK	Miconia	impetiolaris
LIM11	T 00013RBS		INDET		
LIM11	T 00014RBS	Olacaceae	OK	Heisteria	media
LIM11	T 00015RBS	Meliaceae	CF	Guarea	macrophylla
LIM11	T 00016RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
LIM11	T 00017RBS	Moraceae	OK	Poulsenia	armata
LIM11	T 00018RBS	Anacardiaceae	OK	Spondias	radlkoferi
LIM11	T 00019RBS	Urticaceae	OK	Cecropia	obtusifolia
LIM11	T 00020RBS	Sapotaceae	OK	Pouteria	durlandii
LIM11	T 00021RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
LIM11	T 00022RBS	Urticaceae	OK	Cecropia	obtusifolia
LIM11	T 00023RBS	Malvaceae	OK	Trichospermum	grewiifolium
LIM11	T 00024RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
LIM11	P 00001RBS	Arecaceae	OK	Reinhardtia	latisecta
LIM11	P 00002RBS	Arecaceae	OK	Chamaedorea	elegans

LIM11	P 00003RBS	Arecaceae	OK	Chamaedorea	oblongata
LIM11	P 00004RBS	Arecaceae	OK	Calyptrogyne	ghiesbreghtiana
LIM11	P 00005RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM11	P 00006RBS	Arecaceae	OK	Bactris	mexicana
LIM11	F 00001RBS	Hymenophyllaceae	OK	Vandenboschia	radicans
LIM11	F 00002RBS	Dryopteridaceae	OK	Polybotrya	osmundacea
LIM11	F 00003RBS	Pteridaceae	OK	Adiantum	latifolium
LIM11	F 00004RBS		INDET		
LIM11	F 00005RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM11	F 00006RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
LIM11	F 00007RBS		INDET		
LIM11	V 00001RBS	Araceae	CF	Anthurium	scandens
LIM11	V 00002RBS	Araceae	CF	Philodendron	inaequilaterum
LIM11	V 00003RBS	Araceae	OK	Anthurium	scandens
LIM11	V 00004RBS	Araceae	CF	Monstera	acuminata
LIM11	V 00005RBS	Araceae	CF	Syngonium	podophyllum
LIM11	V 00006RBS	Pteridaceae	OK	Anetium	citrifolium
LIM11	V 00007RBS	Araceae	CF	Philodendron	inaequilaterum
LIM11	V 00008RBS	Araceae	CF	Spathiphyllum	
LIM11	V 00009RBS	Bignoniaceae	OK	Amphilophium	paniculatum
LIM11	E 00001RBS	Orchidaceae	INDET		
LIM11	H 00001RBS	Dioscoreaceae	OK	Dioscorea	convolvulacea
LIM11	H 00002RBS	Araceae	OK	Spathiphyllum	blandum
LIM11	H 00003RBS	Marantaceae	OK	Maranta	arundinacea
LIM11	H 00004RBS	Acanthaceae	OK	Justicia	fimbriata
LIM11	H 00005RBS	Poaceae	OK	Streptochaeta	sodiroana
LIM11	H 00006RBS	Cactaceae	OK	Hylocereus	minutiflorus
LIM11	H 00007RBS	Tectariaceae	OK	Tectaria	heracleifolia
LIM11	V 00011RBS	Araceae	CF	Anthurium	schlechtendalii
LIM12	T 00001RBS	Malvaceae	OK	Pachira	aquatica
LIM12	T 00002RBS	Euphorbiaceae	OK	Sebastiania	tuerckheimiana
LIM12	T 00003RBS	Sapindaceae	CF	Exothea	paniculata
LIM12	T 00004RBS	Chrysobalanaceae	OK	Licania	arborea
LIM12	T 00005RBS	Burseraceae	OK	Protium	copal
LIM12	T 00006RBS	Moraceae	OK	Pseudolmedia	spuria
LIM12	T 00007RBS	Sapotaceae	OK	Pouteria	campechiana
LIM12	T 00008RBS	Sapotaceae	OK	Pouteria	amygdalina
LIM12	T 00009RBS	Meliaceae	OK	Guarea	petenensis
LIM12	T 00010RBS	Putranjivaceae	OK	Drypetes	brownii
LIM12	T 00011RBS	Annonaceae	OK	Oxandra	belizensis
LIM12	T 00012RBS	Meliaceae	OK	Trichilia	minutiflora
LIM12	T 00013RBS	Meliaceae	CF	Trichilia	erythrocarpa
LIM12	T 00014RBS	Burseraceae	OK	Protium	copal
LIM12	T 00015RBS	Apocynaceae	OK	Aspidosperma	spruceanum
LIM12	T 00016RBS	Ochnaceae	OK	Ouratea	lucens
LIM12	P 00000RBS	Arecaceae	CF	Geonoma	interrupta
LIM12	P 00000RBS	Arecaceae	OK	Chamaedorea	neurochlamys

LIM12	P 00000RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
LIM12	P 00000RBS	Arecaceae	OK	Sabal	mauritiiformis
LIM12	P 00000RBS	Arecaceae	OK	Astrocaryum	mexicanum
LIM12	P 00000RBS	Arecaceae	OK	Cryosophila	stauracantha
LIM12	V 00001RBS	Araceae	CF	Syngonium	podophyllum
LIM12	V 00002RBS	Araceae	OK	Philodendron	inaequilaterum
LIM12	V 00003RBS	Bignoniaceae	OK	Arrabidaea	chica
LIM12	V 00004RBS	Bignoniaceae	OK	Arrabidaea	chica
LIM12	V 00005RBS	Araceae	CF	Anthurium	pentaphyllum
LIM12	V 00006RBS	Dioscoreaceae	OK	Dioscorea	densiflora
LIM12	V 00007RBS	Araceae	CF	Syngonium	angustatum
LIM12	V 00008RBS	Malpighiaceae	CF	Stigmaphyllon	ellipticum
LIM12	V 00009RBS	Bignoniaceae	OK	Amphilophium	paniculatum
LIM12	H 00000RBS	Orchidaceae	INDET		
LIM12	H 00000RBS	Piperaceae	OK	Piper	jacquemontianum
LIM12	T 00000RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
LIM12	T 00000RBS	Myristicaceae	OK	Compsoneura	mexicana
LIM12	T 00000RBS	Urticaceae	OK	Cecropia	obtusifolia
LIM12	F 00000RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
LIM12	F 00000RBS	Hymenophyllaceae	CF	Vandenboschia	radicans
LIM12	F 00000RBS	Pteridaceae	CF	Pteris	altissima
LIM12	F 00000RBS	Polypodiaceae	CF	Niphidium	crassifolium
LIM12	F 00000RBS	Tectariaceae	CF	Tectaria	mexicana
LIM12	F 00000RBS	Selaginellaceae	OK	Selaginella	umbrosa
LIM12	H 00000RBS	Theophrastaceae	OK	Deherainia	smaragdina
LIM12	H 00000RBS	Zingiberaceae	CF	Renealmia	mexicana
LIM12	H 00000RBS	Araceae	OK	Spathiphyllum	blandum
PLE01	T 00001RBS	Ulmaceae	OK	Ampelocera	hottlei
PLE01	P 00001RBS	Arecaceae	OK	Astrocaryum	mexicanum
PLE01	P 00002RBS	Arecaceae	OK	Attalea	cohune
PLE01	T 00002RBS	Melastomataceae	OK	Mouriri	myrtilloides
PLE01	T 00003RBS	Fabaceae - Mimosoideae	OK	Inga	sapindoides
PLE01	T 00000RBS	Anacardiaceae	OK	Spondias	radlkoferi
PLE01	T 00000RBS	Urticaceae	OK	Cecropia	peltata
PLE01	T 00004RBS		INDET		
PLE01	T 00005RBS	Olacaceae	OK	Heisteria	media
PLE01	T 00006RBS	Moraceae	OK	Pseudolmedia	spuria
PLE01	T 00000RBS	Fabaceae - Mimosoideae	OK	Acacia	cookii
PLE01	T 00007RBS	Fabaceae - Faboideae	OK	Lecointea	amazonica
PLE01	T 00008RBS	Myristicaceae	OK	Compsoneura	mexicana
PLE01	T 00009RBS	Burseraceae	OK	Protium	confusum
PLE01	T 00010RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
PLE01	T 00010RBS	Rubiaceae	OK	Exostema	mexicanum
PLE01	T 00012RBS	Euphorbiaceae	OK	Croton	schiedeanus
PLE01	T 00015RBS	Violaceae	OK	Rinorea	hummelii
PLE01	T 00016RBS	Meliaceae	OK	Trichilia	hirta
PLE01	T 00017RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii

PLE01	T 00018RBS	Piperaceae	OK	Piper	jacquemontianum
PLE01	T 00019RBS	Lauraceae	CF	Nectandra	longicaudata
PLE01	T 00020RBS	Melastomataceae	OK	Mouriri	myrtilloides
PLE01	T 00021RBS	Moraceae	OK	Brosimum	alicastrum
PLE01	T 00022RBS	Sapotaceae	OK	Pouteria	durlandii
PLE01	T 00023RBS	Salicaceae	OK	Homalium	racemosum
PLE01	T 00024RBS	Lauraceae	INDET		
PLE01	T 00026RBS	Fabaceae - Faboideae	OK	Swartzia	simplex
PLE01	T 00027RBS	Sapotaceae	OK	Manilkara	chicle
PLE01	P 00003RBS	Arecaceae	OK	Bactris	mexicana
PLE01	P 00004RBS	Arecaceae	OK	Sabal	mauritiiformis
PLE01	F 00001RBS	Lygodiaceae	OK	Lygodium	heterodoxum
PLE01	V 00001RBS	Araceae	OK	Anthurium	pentaphyllum
PLE01	F 00002RBS	Tectariaceae	OK	Tectaria	heracleifolia
PLE01	F 00003RBS	Pteridaceae	OK	Adiantum	tetraphyllum
PLE01	F 00004RBS	Lygodiaceae	OK	Lygodium	heterodoxum
PLE01	F 00005RBS	Dryopteridaceae	CF	Polybotrya	polybotryoides
PLE01	F 00006RBS	Pteridaceae	CF	Adiantum	tetraphyllum
PLE01	F 00007RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
PLE01	F 00008RBS	Lygodiaceae	OK	Lygodium	heterodoxum
PLE01	V 00002RBS	Araceae	OK	Philodendron	hederaceum
PLE01	H 00002RBS	Orchidaceae	INDET		
PLE01	H 00003RBS	Orchidaceae	INDET		
PLE01	H 00001RBS	Marantaceae	OK	Pleiostachya	pruinosa
PLE01	P 00005RBS	Arecaceae	OK	Chamaedorea	oblongata
PLE01	P 00006RBS	Arecaceae	OK	Chamaedorea	neurochlamys
PLE01	H 00004RBS	Heliconiaceae	CF	Heliconia	aurantiaca
PLE01	T 00011RBS	Fabaceae - Faboideae	INDET	Lonchocarpus	
PLE01	V 00003RBS	Araceae	CF	Philodendron	inaequilaterum
PLE01	T 00029RBS	Araliaceae	OK	Dendropanax	arboreus
PLE01	T 00000RBS	Euphorbiaceae	OK	Sebastiania	tuerckheimiana
PLE01	T 00033RBS	Piperaceae	OK	Piper	psilorhachis
PLE01	T 00000RBS	Salicaceae	OK	Casearia	commersoniana
PLE01	T 00000RBS	Melastomataceae	OK	Mouriri	exilis
PLE01	T 00000RBS	Meliaceae	OK	Trichilia	pallida
PLE01	T 00000RBS	Rubiaceae	OK	Randia	genipifolia
PLE01	T 00000RBS	Rubiaceae	OK	Posoqueria	latifolia
PLE02	T 00001RBS	Vochysiaceae	OK	Vochysia	hondurensis
PLE02	T 00002RBS	Malvaceae	OK	Trichospermum	mexicanum
PLE02	T 00003RBS	Fabaceae - Mimosoideae	OK	Inga	thibaudiana
PLE02	T 00004RBS	Boraginaceae	OK	Cordia	diversifolia
PLE02	T 00005RBS	Combretaceae	OK	Terminalia	amazonia
PLE02	T 00006RBS	Moraceae	OK	Pseudolmedia	glabrata
PLE02	T 00007RBS	Melastomataceae	INDET	Clidemia	
PLE02	T 00008RBS	Boraginaceae	OK	Cordia	diversifolia
PLE02	T 00009RBS	Fabaceae - Caesalpinioideae	OK	Schizolobium	parahyba
PLE02	T 00010RBS	Anacardiaceae	OK	Spondias	radlkoferi

PLE02	T 00011RBS	Myristicaceae	OK	Virola	koschnyi
PLE02	T 00012RBS	Euphorbiaceae	OK	Alchornea	latifolia
PLE02	T 00013RBS		INDET		
PLE02	P 00001RBS	Arecaceae	OK	Attalea	cohune
PLE02	P 00002RBS	Arecaceae	OK	Bactris	mexicana
PLE02	P 00003RBS	Arecaceae	OK	Cryosophila	stauracantha
PLE02	P 00004RBS	Arecaceae	OK	Desmoncus	orthacanthos
PLE02	F 00001RBS	Metaxyaceae	OK	Metaxya	rostrata
PLE02	F 00002RBS	Pteridaceae	OK	Adiantum	petiolatum
PLE02	F 00003RBS	Dryopteridaceae	OK	Polybotrya	caudata
PLE02	F 00004RBS	Cyatheaceae	OK	Sphaeropteris	horrida
PLE02	F 00005RBS	Pteridaceae	CF	Pteris	altissima
PLE02	V 00001RBS	Araceae	OK	Philodendron	hederaceum
PLE02	V 00002RBS	Araceae	CF	Monstera	tuberculata
PLE02	V 00003RBS	Sapindaceae	OK	Paullinia	glomerulosa
PLE02	V 00004RBS		INDET		
PLE02	V 00005RBS	Araceae	INDET		
PLE02	V 00006RBS	Araceae	CF	Monstera	acuminata
PLE02	V 00007RBS	Lygodiaceae	OK	Lygodium	heterodoxum
PLE02	V 00008RBS		INDET		
PLE02	V 00009RBS	Fabaceae - Faboideae	OK	Machaerium	isadelphum
PLE02	V 00010RBS	Dilleniaceae	OK	Doliocarpus	dentatus
PLE02	V 00011RBS	Apocynaceae	INDET		
PLE02	V 00012RBS	Araceae	OK	Philodendron	aurantiifolium
PLE02	V 00013RBS	Asteraceae	CF	Mikania	micrantha
PLE02	V 00014RBS	Melastomataceae	INDET		
PLE02	V 00015RBS	Malpighiaceae	INDET		
PLE02	V 00016RBS	Bignoniaceae	OK	Lundia	puberula
PLE02	H 00001RBS	Melastomataceae	OK	Clidemia	petiolaris
PLE02	H 00002RBS	Poaceae	OK	Pharus	parvifolius
PLE02	H 00003RBS	Poaceae	OK	Pharus	parvifolius
PLE02	H 00004RBS	Heliconiaceae	OK	Heliconia	vaginalis
PLE02	H 00005RBS	Poaceae	OK	Ichnanthus	tenuis
PLE02	H 00006RBS	Costaceae	OK	Costus	pulverulentus
PLE02	F 00006RBS		INDET		
PLE02	H 00007RBS	Rubiaceae	INDET	Psychotria	
PLE02	H 00008RBS	Orchidaceae	INDET		
PLE02	T 00000RBS	Melastomataceae	OK	Miconia	elata
PLE03	T 00001RBS	Boraginaceae	OK	Cordia	bicolor
PLE03	T 00002RBS	Anacardiaceae	OK	Astronium	graveolens
PLE03	T 00003RBS	Malvaceae	OK	Trichospermum	mexicanum
PLE03	T 00004RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
PLE03	T 00005RBS	Euphorbiaceae	OK	Alchornea	latifolia
PLE03	T 00006RBS	Combretaceae	OK	Terminalia	amazonia
PLE03	T 00007RBS	Myristicaceae	OK	Virola	koschnyi
PLE03	T 00008RBS	Meliaceae	CF	Guarea	macrophylla
PLE03	T 00009RBS	Combretaceae	OK	Terminalia	oblonga

PLE03	T 00010RBS	Fabaceae - Faboideae	OK	Vatairea	lundellii
PLE03	T 00011RBS	Rubiaceae	INDET	Psychotria	
PLE03	T 00012RBS	Chrysobalanaceae	OK	Licania	hypoleuca
PLE03	T 00013RBS	Sapotaceae	OK	Manilkara	chicle
PLE03	T 00014RBS	Elaeocarpaceae	OK	Sloanea	tuerckheimii
PLE03	T 00015RBS	Rubiaceae	OK	Faramea	occidentalis
PLE03	T 00021RBS	Urticaceae	OK	Cecropia	peltata
PLE03	T 00016RBS	Fabaceae - Mimosoideae	OK	Inga	thibaudiana
PLE03	T 00017RBS	Sapindaceae	OK	Cupania	belizensis
PLE03	T 00018RBS	Melastomataceae	OK	Miconia	insularis
PLE03	T 00022RBS	Burseraceae	OK	Bursera	simaruba
PLE03	T 00019RBS	Salicaceae	OK	Casearia	tremula
PLE03	P 00001RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
PLE03	P 00002RBS	Arecaceae	OK	Chamaedorea	neurochlamys
PLE03	P 00003RBS	Arecaceae	OK	Astrocaryum	mexicanum
PLE03	P 00004RBS	Arecaceae	OK	Bactris	mexicana
PLE03	P 00005RBS	Arecaceae	OK	Attalea	cohune
PLE03	F 00001RBS	Pteridaceae	OK	Pteris	grandifolia
PLE03	F 00002RBS	Dryopteridaceae	OK	Polybotrya	caudata
PLE03	F 00003RBS	Tectariaceae	OK	Dictyoxiphium	panamense
PLE03	F 00004RBS	Pteridaceae	OK	Adiantum	petiolatum
PLE03	F 00005RBS	Pteridaceae	CF	Adiantum	tetraphyllum
PLE03	F 00006RBS	Pteridaceae	OK	Pteris	quadriaurita
PLE03	F 00007RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
PLE03	F 00008RBS	Cyatheaceae	OK	Sphaeropteris	horrida
PLE03	H 00002RBS	Rubiaceae	CF	Psychotria	poeppigiana
PLE03	H 00001RBS	Poaceae	OK	Olyra	latifolia
PLE03	H 00003RBS	Costaceae	CF	Costus	pulverulentus
PLE03	H 00004RBS	Orchidaceae	INDET		
PLE03	H 00005RBS	Heliconiaceae	OK	Heliconia	vaginalis
PLE03	H 00008RBS	Melastomataceae	OK	Miconia	lacera
PLE03	H 00007RBS	Cyperaceae	INDET	Scleria	
PLE03	H 00006RBS	Poaceae	OK	Ichnanthus	tenuis
PLE03	H 00009RBS		INDET		
PLE03	H 00010RBS	Araceae	OK	Spathiphyllum	blandum
PLE03	V 00001RBS	Dioscoreaceae	OK	Dioscorea	bartlettii
PLE03	V 00002RBS	Araceae	OK	Philodendron	radiatum
PLE03	V 00003RBS	Araceae	OK	Syngonium	podophyllum
PLE03	V 00004RBS	Araceae	CF	Monstera	tuberculata
PLE03	T 00020RBS	Anacardiaceae	OK	Spondias	radlkoferi
PLE03	V 00000RBS	Araceae	CF	Anthurium	scandens
PLE03	F 00001RBS	Metaxyaceae	OK	Metaxya	rostrata
PLE03	GLH00001RBS	Rubiaceae	OK	Psychotria	poeppigiana
PLE04	T 00001RBS	Moraceae	OK	Brosimum	alicastrum
PLE04	T 00002RBS	Anacardiaceae	OK	Spondias	radlkoferi
PLE04	T 00003RBS	Euphorbiaceae	CF	Alchornea	latifolia
PLE04	T 00004RBS	Euphorbiaceae	OK	Alchornea	latifolia

PLE04	T 00005RBS	Apocynaceae	OK	Mortoniella	pittieri
PLE04	T 00006RBS	Rubiaceae	OK	Alseis	yucatanensis
PLE04	T 00007RBS	Fabaceae	OK	Senegalia	polyphylla
PLE04	T 00008RBS	Anacardiaceae	OK	Astronium	graveolens
PLE04	T 00009RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
PLE04	T 00010RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
PLE04	T 00010RBS	Sapotaceae	OK	Manilkara	chicle
PLE04	T 00011RBS	Bignoniaceae	OK	Tabebuia	chrysantha
PLE04	T 00012RBS	Ulmaceae	OK	Ampelocera	hottlei
PLE04	T 00013RBS	Sapotaceae	OK	Pouteria	sapota
PLE04	T 00014RBS	Malvaceae	OK	Guazuma	ulmifolia
PLE04	T 00015RBS	Lauraceae	OK	Ocotea	cernua
PLE04	T 00016RBS	Urticaceae	OK	Cecropia	peltata
PLE04	T 00017RBS	Apocynaceae	OK	Aspidosperma	megalocarpon
PLE04	T 00018RBS	Boraginaceae	OK	Cordia	diversifolia
PLE04	T 00019RBS	Apocynaceae	OK	Mortoniella	pittieri
PLE04	P 00001RBS	Arecaceae	OK	Attalea	cohune
PLE04	P 00002RBS	Arecaceae	OK	Astrocaryum	mexicanum
PLE04	P 00003RBS	Arecaceae	OK	Bactris	mexicana
PLE04	P 00004RBS	Arecaceae	OK	Desmoncus	orthacanthos
PLE04	P 00005RBS	Arecaceae	OK	Chamaedorea	tepejilote
PLE04	P 00006RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
PLE04	P 00007RBS	Arecaceae	OK	Sabal	mauritiiformis
PLE04	P 00008RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
PLE04	F 00001RBS	Selaginellaceae	OK	Selaginella	umbrosa
PLE04	F 00002RBS	Pteridaceae	OK	Adiantum	tetraphyllum
PLE04	F 00003RBS		INDET		
PLE04	F 00004RBS	Pteridaceae	OK	Adiantum	trapeziforme
PLE04	F 00005RBS	Tectariaceae	OK	Tectaria	rivalis
PLE04	F 00006RBS	Lygodiaceae	OK	Lygodium	heterodoxum
PLE04	V 00001RBS	Bignoniaceae	CF	Martinella	obovata
PLE04	V 00002RBS	Rubiaceae	CF	Manettia	reclinata
PLE04	V 00003RBS	Araceae	CF	Monstera	acuminata
PLE04	V 00004RBS	Bignoniaceae	CF	Amphilophium	paniculatum
PLE04	V 00005RBS	Araceae	OK	Philodendron	hederaceum
PLE04	V 00006RBS	Araceae	OK	Anthurium	microspadix
PLE04	V 00007RBS	Araceae	OK	Anthurium	pentaphyllum
PLE04	V 00008RBS	Vitaceae	CF	Cissus	microcarpa
PLE04	V 00009RBS		INDET		
PLE04	V 00010RBS	Bignoniaceae	CF	Martinella	obovata
PLE04	SH 00001RBS		INDET		
PLE04	SH 00002RBS	Bignoniaceae	CF	Stizophyllum	riparium
PLE04	H 00001RBS	Marantaceae	OK	Pleiostachya	pruinosa
PLE04	GLH00002RBS	Araceae	CF	Spathiphyllum	blandum
PLE04	T 00000RBS	Fabaceae	OK	Senegalia	polyphylla
PLE05	T 00001RBS	Anacardiaceae	OK	Spondias	radlkoferi
PLE05	T 00002RBS	Burseraceae	OK	Bursera	simaruba

PLE05	T 00003RBS	Bignoniaceae	OK	Tabebuia	chrysantha
PLE05	T 00004RBS	Anacardiaceae	OK	Astronium	graveolens
PLE05	T 00005RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
PLE05	T 00006RBS	Boraginaceae	OK	Cordia	bicolor
PLE05	T 00007RBS	Apocynaceae	OK	Aspidosperma	spruceanum
PLE05	T 00008RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
PLE05	T 00009RBS	Rubiaceae	OK	Cosmocalyx	spectabilis
PLE05	T 00010RBS	Rubiaceae	OK	Alseis	yucatanensis
PLE05	T 00011RBS	Malvaceae	OK	Trichospermum	grewiifolium
PLE05	T 00012RBS	Lauraceae	CF	Cinnamomum	triplinerve
PLE05	T 00013RBS	Ulmaceae	OK	Ampelocera	hottlei
PLE05	T 00014RBS		INDET		
PLE05	T 00015RBS	Fabaceae - Mimosoideae	OK	Cojoba	arborea
PLE05	T 00016RBS	Urticaceae	OK	Cecropia	peltata
PLE05	T 00017RBS		INDET		
PLE05	T 00018RBS	Moraceae	OK	Castilla	elastica
PLE05	T 00019RBS	Moraceae	OK	Pseudolmedia	glabrata
PLE05	T 00020RBS	Combretaceae	OK	Terminalia	amazonia
PLE05	T 00021RBS	Fabaceae - Faboideae	OK	Vatairea	lundellii
PLE05	T 00022RBS	Moraceae	OK	Brosimum	alicastrum
PLE05	T 00023RBS	Malvaceae	OK	Quararibea	funebris
PLE05	T 00024RBS	Theophrastaceae	OK	Deherainia	smaragdina
PLE05	T 00025RBS	Melastomataceae	OK	Mouriri	myrtilloides
PLE05	P 00001RBS	Arecaceae	OK	Chamaedorea	neurochlamys
PLE05	P 00002RBS	Arecaceae	OK	Chamaedorea	oblongata
PLE05	P 00003RBS	Arecaceae	OK	Sabal	mauritiiformis
PLE05	P 00004RBS	Arecaceae	OK	Attalea	cohune
PLE05	P 00005RBS	Arecaceae	OK	Astrocaryum	mexicanum
PLE05	P 00006RBS	Arecaceae	OK	Bactris	mexicana
PLE05	P 00007RBS	Arecaceae	OK	Desmoncus	orthacanthos
PLE05	F 00001RBS		INDET		
PLE05	F 00002RBS	Selaginellaceae	OK	Selaginella	umbrosa
PLE05	F 00003RBS	Pteridaceae	OK	Adiantum	tetraphyllum
PLE05	V 00001RBS	Araceae	CF	Monstera	tuberculata
PLE05	V 00002RBS	Sapindaceae	OK	Paullinia	costaricensis
PLE05	V 00003RBS	Rubiaceae	OK	Geophila	repens
PLE05	V 00004RBS	Dilleniaceae	OK	Tetracera	volubilis
PLE05	V 00005RBS	Araceae	CF	Monstera	tuberculata
PLE05	V 00006RBS	Araceae	OK	Philodendron	hederaceum
PLE05	V 00007RBS	Dioscoreaceae	INDET	Dioscorea	
PLE05	V 00008RBS	Araceae	INDET	Philodendron	
PLE05	V 00009RBS	Araceae	OK	Syngonium	podophyllum
PLE05	V 00010RBS	Araceae	CF	Spathiphyllum	
PLE05	V 00011RBS		INDET		
PLE05	V 00012RBS	Sapindaceae	CF	Paullinia	costaricensis
PLE05	V 00013RBS	Araceae	OK	Anthurium	pentaphyllum
PLE05	V 00014RBS	Fabaceae - Faboideae	OK	Machaerium	isadelphum

PLE05	H 00001RBS	Orchidaceae	INDET		
PLE05	H 00002RBS	Marantaceae	OK	Pleiostachya	pruinosa
PLE05	H 00003RBS	Urticaceae	OK	Pilea	pansamalana
PLE05	H 00004RBS	Costaceae	INDET	Costus	
PLE05	H 00005RBS	Marantaceae	OK	Pleiostachya	pruinosa
PLE05	H 00006RBS	Piperaceae	OK	Piper	jacquemontianum
PLE05	H 00007RBS	Poaceae	OK	Pharus	parvifolius
PLE05	H 00008RBS	Poaceae	INDET	Lasiacis	
PLE05	SH 00001RBS	Piperaceae	OK	Piper	schippianum
PLE05	V 00002RBS	Araceae	CF	Monstera	tuberculata
PLE05	V 00007RBS	Bignoniaceae	CF	Amphilophium	paniculatum
ROA01	00001RBS	Asteraceae	OK	Bidens	squarrosa
ROA01	00002RBS	Fabaceae - Faboideae	OK	Vigna	peduncularis
ROA01	00003RBS	Convolvulaceae	OK	Ipomoea	batatas
ROA01	00004RBS	Apocynaceae	CF	Mesechites	trifidus
ROA01	00005RBS	Convolvulaceae	OK	Merremia	umbellata
ROA01	00006RBS	Fabaceae - Caesalpinioideae	INDET	Chamaecrista	
ROA01	00007RBS	Fabaceae - Caesalpinioideae	OK	Senna	hayesiana
ROA01	00008RBS	Asteraceae	OK	Bidens	pilosa
ROA01	00009RBS	Convolvulaceae	OK	Merremia	quinquefolia
ROA01	00010RBS	Asteraceae	OK	Chromolaena	odorata
ROA01	00011RBS	Lamiaceae	INDET		
ROA01	00012RBS	Malvaceae	OK	Sida	rhombifolia
ROA01	00013RBS		INDET		
ROA01	00014RBS	Boraginaceae	OK	Cordia	curassavica
ROA01	00015RBS	Fabaceae - Faboideae	INDET		
ROA01	00016RBS	Fabaceae - Faboideae	OK	Vigna	lasiocarpa
ROA01	00017RBS	Passifloraceae	OK	Passiflora	foetida
ROA01	00018RBS	Phyllanthaceae	CF	Phyllanthus	amarus
ROA01	00019RBS	Euphorbiaceae	INDET		
ROA01	00020RBS	Fabaceae - Faboideae	CF	Desmodium	incanum
ROA01	00021RBS	Boraginaceae	OK	Cordia	spinescens
ROA01	00022RBS	Phyllanthaceae	CF	Phyllanthus	amarus
ROA01	00023RBS	Fabaceae - Faboideae	CF	Desmodium	incanum
ROA01	00024RBS	Fabaceae - Faboideae	INDET		
ROA01	00025RBS	Acanthaceae	INDET	Aphelandra	
ROA01	00026RBS	Phyllanthaceae	OK	Phyllanthus	compressus
ROA01	00027RBS	Fabaceae - Mimosoideae	OK	Mimosa	asperata
ROA01	00028RBS	Verbenaceae	OK	Lantana	trifolia
ROA01	00029RBS	Asteraceae	INDET	Ageratum	
ROA01	00030RBS	Fabaceae - Caesalpinioideae	OK	Senna	undulata
ROA01	00031RBS	Euphorbiaceae	INDET		
ROA01	00032RBS	Poaceae	INDET		
ROA01	00033RBS	Boraginaceae	OK	Cordia	curassavica
ROA01	00034RBS	Fabaceae - Faboideae	INDET		
ROA01	00035RBS		INDET		
ROA01	00036RBS	Lamiaceae	INDET		

ROA01	00037RBS	Convolvulaceae	OK	Merremia	quinquefolia
ROA01	00038RBS	Piperaceae	OK	Piper	hispidum
ROA01	00039RBS	Anacardiaceae	OK	Spondias	radlkoferi
ROA01	00040RBS	Rhamnaceae	OK	Gouania	polygama
ROA01	00041RBS	Fabaceae - Faboideae	OK	Lonchocarpus	guatemalensis
ROA01	00042RBS	Apocynaceae	OK	Tabernaemontana	alba
ROA01	00043RBS	Pteridaceae	OK	Pteris	grandifolia
ROA01	00044RBS	Fabaceae	INDET		
ROA01	00045RBS	Nyctaginaceae	OK	Neea	psychotrioides
ROA01	00046RBS	Boraginaceae	OK	Cordia	curassavica
ROA01	00047RBS	Malvaceae	OK	Sida	acuta
ROA01	00048RBS	Araceae	CF	Syngonium	angustatum
ROA01	00049RBS	Asteraceae	INDET		
ROA01	00050RBS	Pteridaceae	OK	Pityrogramma	calomelanos
ROA01	00051RBS	Pteridaceae	OK	Pteris	longifolia
ROA01	00052RBS	Fabaceae - Mimosoideae	OK	Calliandra	belizensis
ROA01	00053RBS	Passifloraceae	OK	Passiflora	foetida
ROA01	00054RBS	Lamiaceae	OK	Cornutia	pyramidata
ROA01	00055RBS		INDET		
ROA01	00056RBS	Chrysobalanaceae	OK	Couepia	polyandra
ROA01	00057RBS	Onagraceae	OK	Ludwigia	octovalvis
ROA01	00058RBS	Asteraceae	OK	Wedelia	trilobata
ROA01	00059RBS	Verbenaceae	OK	Stachytarpheta	jamaicensis
ROA01	00060RBS		INDET		
ROA01	T 00000RBS	Malpighiaceae	OK	Byrsonima	crassifolia
ROA02	00001RBS	Fabaceae - Mimosoideae	OK	Calliandra	houstoniana
ROA02	00002RBS	Verbenaceae	INDET	Lantana	camara
ROA02	00003RBS	Turneraceae	OK	Turnera	aromatica
ROA02	00004RBS	Convolvulaceae	OK	Ipomoea	batatas
ROA02	00005RBS	Asteraceae	INDET	Ageratum	
ROA02	00006RBS	Asteraceae	OK	Bidens	squarrosa
ROA02	00007RBS	Asteraceae	CF	Lasianthaea	fruticosa
ROA02	00008RBS	Rubiaceae	OK	Diodella	apiculata
ROA02	00009RBS	Fabaceae - Mimosoideae	OK	Pithecellobium	macrandrium
ROA02	00010RBS	Asteraceae	OK	Vernonia	tortuosa
ROA02	00011RBS	Turneraceae	OK	Turnera	aromatica
ROA02	00012RBS	Fabaceae - Faboideae	OK	Vigna	peduncularis
ROA02	00013RBS	Fabaceae - Faboideae	OK	Pachyrhizus	erosus
ROA02	00014RBS	Verbenaceae	CF	Lantana	camara
ROA02	00015RBS	Lamiaceae	INDET		
ROA02	00016RBS	Fabaceae - Mimosoideae	OK	Calliandra	houstoniana
ROA02	00017RBS	Euphorbiaceae	OK	Dalechampia	laevigata
ROA02	00018RBS	Asteraceae	OK	Wedelia	trilobata
ROA02	00019RBS	Fabaceae - Faboideae	OK	Pachyrhizus	ferrugineus
ROA02	00020RBS	Asteraceae	CF	Critonia	bartlettii
ROA02	00021RBS		INDET		
ROA02	00022RBS		INDET		

ROA02	00023RBS	Asteraceae	INDET	Critonia	
ROA02	00024RBS	Piperaceae	OK	Piper	hispidum
ROA02	00025RBS	Bignoniaceae	OK	Arrabidaea	candicans
ROA02	00026RBS	Fabaceae - Faboideae	CF	Vigna	adenantha
ROA02	00027RBS	Araceae	CF	Philodendron	hederaceum
ROA02	00028RBS		INDET		
ROA02	00029RBS		INDET		
ROA02	00030RBS	Malpighiaceae	OK	Byrsonima	crassifolia
ROA02	00031RBS	Salicaceae	OK	Zuelania	guidonia
ROA02	00032RBS	Malvaceae	OK	Trichospermum	grewiifolium
ROA02	00033RBS		INDET		
ROA02	00034RBS		INDET		
ROA02	00035RBS		INDET		
ROA02	00036RBS		INDET		
ROA02	00037RBS		INDET		
ROA02	00038RBS		INDET		
ROA02	00039RBS		INDET		
ROA02	00040RBS		INDET		
ROA02	00041RBS		INDET		
ROA02	00042RBS		INDET		
TBE01	T 00001RBS	Bignoniaceae	OK	Tabebuia	chrysantha
TBE01	T 00002RBS	Burseraceae	OK	Protium	confusum
TBE01	T 00003RBS	Burseraceae	OK	Bursera	simaruba
TBE01	T 00004RBS	Vochysiaceae	OK	Vochysia	hondurensis
TBE01	T 00005RBS	Boraginaceae	OK	Cordia	diversifolia
TBE01	T 00006RBS	Anacardiaceae	OK	Spondias	radlkoferi
TBE01	T 00007RBS	Moraceae	INDET		
TBE01	T 00008RBS	Malvaceae	OK	Guazuma	ulmifolia
TBE01	T 00009RBS	Malvaceae	OK	Ceiba	pentandra
TBE01	T 00010RBS	Fabaceae - Mimosoideae	OK	Inga	cocleensis
TBE01	T 00011RBS	Euphorbiaceae	OK	Croton	billbergianus
TBE01	T 00012RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
TBE01	T 00013RBS	Moraceae	CF	Brosimum	alicastrum
TBE01	T 00000RBS	Sapindaceae	OK	Cupania	spectabilis
TBE01	H 00001RBS	Poaceae	OK	Ichnanthus	tenuis
TBE01	H 00007RBS	Rubiaceae	INDET	Psychotria	
TBE01	P 00001RBS	Arecaceae	OK	Attalea	cohune
TBE01	P 00002RBS	Arecaceae	OK	Bactris	mexicana
TBE01	P 00003RBS	Arecaceae	OK	Desmoncus	orthacanthos
TBE01	P 00004RBS	Poaceae	OK	Ichnanthus	tenuis
TBE01	H 00004RBS	Costaceae	OK	Costus	pulverulentus
TBE01	F 00001RBS	Lygodiaceae	OK	Lygodium	heterodoxum
TBE01	F 00002RBS	Pteridaceae	OK	Adiantum	petiolatum
TBE01	F 00003RBS	Selaginellaceae	OK	Selaginella	umbrosa
TBE01	F 00004RBS		INDET		
TBE01	F 00005RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
TBE01	F 00006RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii

TBE01	F 00007RBS	Tectariaceae	OK	Dictyoxiphium	panamense
TBE01	F 00008RBS	Thelypteridaceae	OK	Thelypteris	hondurensis
TBE01	F 00009RBS		INDET		
TBE01	V 00001RBS	Dilleniaceae	OK	Tetracera	volubilis
TBE01	V 00002RBS	Bignoniaceae	OK	Callichlamys	latifolia
TBE01	V 00003RBS	Asteraceae	INDET		
TBE01	V 00004RBS	Bignoniaceae	CF	Callichlamys	latifolia
TBE01	V 00005RBS	Araceae	INDET	Monstera	
TBE01	V 00006RBS	Euphorbiaceae	CF	Dalechampia	schottii
TBE01	V 00007RBS	Araceae	CF	Philodendron	inaequilaterum
TBE01	V 00008RBS	Fabaceae - Faboideae	OK	Machaerium	isadelphum
TBE01	V 00009RBS	Fabaceae - Faboideae	OK	Vigna	luteola
TBE01	V 00010RBS	Araceae	CF	Anthurium	pentaphyllum
TBE01	V 00011RBS	Araceae	INDET	Anthurium	
TBE01	V 00012RBS	Rubiaceae	CF	Randia	retroflexa
TBE01	V 00013RBS	Araceae	CF	Philodendron	radiatum
TBE01	H 00002RBS	Heliconiaceae	OK	Heliconia	vaginalis
TBE01	H 00003RBS		INDET		
TBE01	H 00005RBS	Zingiberaceae	OK	Renealmia	mexicana
TBE01	H 00006RBS	Marantaceae	OK	Pleiostachya	pruinosa
TBE01	H 00008RBS	Rubiaceae	CF	Psychotria	poeppigiana
TBE01	H 00009RBS	Cyperaceae	INDET	Scleria	
TBE01	T 00000RBS	Anacardiaceae	OK	Astronium	graveolens
TBE01	T 00000RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
TBE01	T 00000RBS	Melastomataceae	OK	Miconia	hondurensis
TBE01	T 00000RBS	Melastomataceae	OK	Miconia	serrulata
TBE01	V 00002RBS	Araceae	CF	Philodendron	radiatum
TBE01	H 00004RBS	Poaceae	OK	Pharus	parvifolius
TBE02	T 00001RBS		INDET		
TBE02	T 00002RBS	Moraceae	INDET		
TBE02	T 00003RBS	Araliaceae	OK	Dendropanax	arboreus
TBE02	T 00004RBS	Fabaceae - Mimosoideae	OK	Acacia	cookii
TBE02	T 00005RBS	Urticaceae	OK	Cecropia	peltata
TBE02	T 00006RBS	Fabaceae - Mimosoideae	OK	Inga	cocleensis
TBE02	T 00007RBS		INDET		
TBE02	T 00008RBS	Fabaceae - Mimosoideae	OK	Inga	cocleensis
TBE02	T 00009RBS	Euphorbiaceae	OK	Sapium	lateriflorum
TBE02	T 00010RBS	Boraginaceae	OK	Cordia	stellifera
TBE02	T 00011RBS	Malvaceae	OK	Trichospermum	mexicanum
TBE02	T 00012RBS	Rubiaceae	OK	Morinda	panamensis
TBE02	T 00013RBS	Rutaceae	OK	Zanthoxylum	ekmanii
TBE02	T 00014RBS	Euphorbiaceae	OK	Croton	billbergianus
TBE02	T 00015RBS	Burseraceae	OK	Bursera	simaruba
TBE02	T 00016RBS	Anacardiaceae	OK	Spondias	radlkoferi
TBE02	T 00017RBS	Malvaceae	OK	Guazuma	ulmifolia
TBE02	T 00018RBS	Salicaceae	OK	Zuelania	guidonia
TBE02	P 00001RBS	Arecaceae	OK	Sabal	mauritiiformis

TBE02	P 00002RBS	Arecaceae	OK	Attalea	cohune
TBE02	P 00003RBS	Arecaceae	OK	Bactris	mexicana
TBE02	P 00004RBS	Arecaceae	OK	Desmoncus	orthacanthos
TBE02	F 00001RBS	Thelypteridaceae	INDET	Thelypteris	
TBE02	F 00002RBS	Selaginellaceae	OK	Selaginella	umbrosa
TBE02	F 00003RBS	Pteridaceae	OK	Adiantum	petiolatum
TBE02	F 00004RBS	Lygodiaceae	OK	Lygodium	heterodoxum
TBE02	F 00005RBS		INDET		
TBE02	F 00006RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
TBE02	F 00007RBS	Thelypteridaceae	INDET	Thelypteris	
TBE02	F 00008RBS	Pteridaceae	OK	Adiantum	tetraphyllum
TBE02	V 00001RBS	Poaceae	OK	Ichnanthus	tenuis
TBE02	V 00002RBS	Rubiaceae	OK	Geophila	repens
TBE02	V 00003RBS	Dilleniaceae	OK	Davilla	nitida
TBE02	V 00004RBS	Araceae	OK	Philodendron	inaequilaterum
TBE02	V 00005RBS	Bignoniaceae	CF	Martinella	obovata
TBE02	V 00006RBS	Araceae	CF	Philodendron	hederaceum
TBE02	V 00007RBS		INDET		
TBE02	V 00008RBS		INDET		
TBE02	V 00009RBS	Araceae	OK	Philodendron	radiatum
TBE02	F 00009RBS	Tectariaceae	OK	Dictyoxiphium	panamense
TBE02	H 00001RBS	Poaceae	INDET		
TBE02	H 00002RBS	Poaceae	INDET		
TBE02	H 00003RBS	Heliconiaceae	OK	Heliconia	vaginalis
TBE02	H 00004RBS	Marantaceae	OK	Pleiostachya	pruinosa
TBE02	H 00005RBS		INDET		
TBE02	H 00006RBS	Costaceae	OK	Costus	pulverulentus
TBE02	H 00007RBS	Heliconiaceae	OK	Heliconia	aurantiaca
TBE02	SH 00001RBS	Melastomataceae	OK	Clidemia	petiolaris
TBE02	T 00000RBS	Fabaceae - Faboideae	OK	Dalbergia	stevensonii
TBE02	T 00000RBS	Melastomataceae	OK	Mouriri	myrtilloides
TBE02	E 00002RBS	Pteridaceae	OK	Vittaria	lineata
TBE02	T 00000RBS	Moraceae	OK	Ficus	maxima
TBE02	V 00010RBS	Sapindaceae	OK	Paullinia	costaricensis
TBE02	T 00000RBS	Melastomataceae	OK	Miconia	hondurensis
TBE02	T 00000RBS	Rutaceae	OK	Zanthoxylum	juniperinum
TBE03	T 00001RBS	Anacardiaceae	OK	Spondias	radlkoferi
TBE03	T 00002RBS	Moraceae	INDET		
TBE03	T 00003RBS	Malvaceae	OK	Trichospermum	mexicanum
TBE03	T 00004RBS	Fabaceae - Mimosoideae	INDET	Inga	
TBE03	T 00005RBS	Sapotaceae	OK	Manilkara	chicle
TBE03	T 00006RBS	Fabaceae	OK	Senegalia	polyphylla
TBE03	T 00007RBS	Malvaceae	OK	Pachira	aquatica
TBE03	T 00008RBS	Fabaceae - Faboideae	OK	Pterocarpus	officinalis
TBE03	T 00009RBS	Urticaceae	OK	Cecropia	peltata
TBE03	T 00010RBS	Salicaceae	OK	Zuelania	guidonia
TBE03	T 00011RBS	Fabaceae - Faboideae	OK	Andira	inermis

TBE03	T 00012RBS	Lauraceae	OK	Ocotea	cernua
TBE03	T 00013RBS	Polygonaceae	OK	Coccoloba	belizensis
TBE03	T 00014RBS	Euphorbiaceae	OK	Adelia	barbinervis
TBE03	T 00015RBS	Boraginaceae	OK	Cordia	diversifolia
TBE03	T 00016RBS	Sapotaceae	OK	Pouteria	durlandii
TBE03	T 00017RBS	Rutaceae	OK	Zanthoxylum	ekmanii
TBE03	T 00018RBS	Acanthaceae	OK	Odontonema	hondurense
TBE03	T 00019RBS	Fabaceae - Mimosoideae	OK	Lysiloma	acapulcense
TBE03	T 00020RBS	Moraceae	OK	Ficus	maxima
TBE03	T 00021RBS	Rubiaceae	CF	Randia	matudae
TBE03	P 00001RBS	Arecaceae	OK	Attalea	cohune
TBE03	P 00002RBS	Arecaceae	OK	Bactris	mexicana
TBE03	P 00003RBS	Arecaceae	OK	Astrocaryum	mexicanum
TBE03	P 00004RBS	Arecaceae	OK	Cryosophila	stauracantha
TBE03	P 00005RBS	Arecaceae	OK	Sabal	mauritiiformis
TBE03	P 00006RBS	Arecaceae	OK	Desmoncus	orthacanthos
TBE03	F 00001RBS	Selaginellaceae	OK	Selaginella	umbrosa
TBE03	F 00002RBS	Lygodiaceae	OK	Lygodium	venustum
TBE03	F 00003RBS	Pteridaceae	OK	Adiantum	capillus-veneris
TBE03	F 00004RBS	VOUCHER MISSING	INDET		
TBE03	F 00005RBS	Pteridaceae	OK	Adiantum	tetraphyllum
TBE03	F 00006RBS	Lygodiaceae	OK	Lygodium	venustum
TBE03	F 00007RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
TBE03	F 00008RBS	Tectariaceae	OK	Tectaria	heracleifolia
TBE03	V 00001RBS	Araceae	OK	Philodendron	inaequilaterum
TBE03	V 00002RBS	Araceae	OK	Philodendron	radiatum
TBE03	V 00003RBS	Bignoniaceae	OK	Arrabidaea	chica
TBE03	V 00004RBS	Menispermaceae	OK	Abuta	steyermarkii
TBE03	V 00005RBS	Araceae	INDET		
TBE03	V 00006RBS	Araceae	CF	Philodendron	hederaceum
TBE03	V 00007RBS	Araceae	CF	Syngonium	angustatum
TBE03	V 00008RBS	Araceae	CF	Monstera	acuminata
TBE03	V 00009RBS	Araceae	CF	Monstera	acuminata
TBE03	V 00010RBS	Bignoniaceae	CF	Lundia	puberula
TBE03	V 00011RBS	Araceae	CF	Anthurium	pentaphyllum
TBE03	V 00012RBS	Bignoniaceae	INDET		
TBE03	V 00013RBS	Bignoniaceae	OK	Macfadyena	uncata
TBE03	V 00014RBS	Dilleniaceae	OK	Tetracera	volubilis
TBE03	H 00001RBS	Araceae	OK	Spathiphyllum	blandum
TBE03	SH 00001RBS	Rubiaceae	OK	Morinda	panamensis
TBE03	SH 00002RBS	Piperaceae	OK	Piper	jacquemontianum
TBE03	V 00006RBS	Fabaceae - Faboideae	INDET	Machaerium	
TBE04	T 00001RBS		INDET		
TBE04	T 00002RBS	Fabaceae - Faboideae	OK	Andira	inermis
TBE04	T 00003RBS	Anacardiaceae	OK	Spondias	radlkoferi
TBE04	T 00004RBS	Fabaceae - Faboideae	OK	Dalbergia	stevensonii
TBE04	T 00005RBS	Boraginaceae	OK	Cordia	diversifolia

TBE04	T 00006RBS	Fabaceae - Faboideae	OK	Vatairea	lundellii
TBE04	T 00007RBS	Burseraceae	OK	Bursera	simaruba
TBE04	T 00008RBS	Malvaceae	OK	Pachira	aquatica
TBE04	T 00009RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
TBE04	T 00010RBS	Sapotaceae	OK	Pouteria	reticulata
TBE04	T 00011RBS	Fabaceae - Faboideae	OK	Lecointea	amazonica
TBE04	T 00012RBS	Urticaceae	OK	Cecropia	peltata
TBE04	T 00013RBS	Bignoniaceae	OK	Tabebuia	chrysantha
TBE04	T 00014RBS	Sapotaceae	OK	Pouteria	durlandii
TBE04	T 00015RBS	Polygonaceae	OK	Coccoloba	tuerckheimii
TBE04	T 00016RBS	Apocynaceae	OK	Aspidosperma	spruceanum
TBE04	T 00017RBS	Burseraceae	OK	Protium	confusum
TBE04	T 00018RBS	Boraginaceae	OK	Cordia	diversifolia
TBE04	T 00019RBS	Fabaceae - Mimosoideae	INDET	Inga	
TBE04	T 00020RBS	Chrysobalanaceae	OK	Hirtella	guatemalensis
TBE04	T 00021RBS	Rubiaceae	OK	Cosmocalyx	spectabilis
TBE04	T 00022RBS	Fabaceae - Mimosoideae	OK	Cojoba	graciliflora
TBE04	T 00023RBS	Euphorbiaceae	OK	Croton	schiedeanus
TBE04	P 00001RBS	Arecaceae	OK	Cryosophila	stauracantha
TBE04	P 00002RBS	Arecaceae	OK	Attalea	cohune
TBE04	P 00003RBS	Arecaceae	OK	Bactris	mexicana
TBE04	P 00004RBS	Arecaceae	OK	Sabal	mauritiiformis
TBE04	P 00005RBS	Arecaceae	OK	Astrocaryum	mexicanum
TBE04	F 00001RBS	Selaginellaceae	OK	Selaginella	umbrosa
TBE04	F 00002RBS	Lygodiaceae	OK	Lygodium	venustum
TBE04	F 00003RBS	Tectariaceae	OK	Tectaria	heracleifolia
TBE04	F 00004RBS		INDET		
TBE04	F 00005RBS	Lomariopsidaceae	OK	Nephrolepis	biserrata
TBE04	F 00006RBS		INDET		
TBE04	F 00007RBS	Lygodiaceae	OK	Lygodium	heterodoxum
TBE04	F 00008RBS	Lygodiaceae	OK	Lygodium	venustum
TBE04	V 00001RBS	Dilleniaceae	OK	Tetracera	volubilis
TBE04	V 00002RBS	Araceae	CF	Philodendron	radiatum
TBE04	V 00003RBS	Bignoniaceae	INDET		
TBE04	V 00004RBS	Celastraceae	OK	Hippocratea	volubilis
TBE04	V 00005RBS	Sapindaceae	CF	Serjania	mexicana
TBE04	V 00006RBS	Euphorbiaceae	CF	Dalechampia	schottii
TBE04	V 00007RBS	Bignoniaceae	OK	Macfadyena	uncata
TBE04	V 00008RBS	Apocynaceae	INDET		
TBE04	V 00009RBS		INDET		
TBE04	V 00010RBS	Araceae	CF	Philodendron	hederaceum
TBE04	V 00011RBS	Araceae	INDET	Monstera	
TBE04	L 00001RBS	Fabaceae - Faboideae	OK	Machaerium	floribundum
TBE04	L 00002RBS	Celastraceae	CF	Cheiloclinium	belizense
TBE04	SH 00001RBS	Poaceae	OK	Pharus	parvifolius
TBE04	SH 00002RBS		INDET		
TBE04	SH 00003RBS	Piperaceae	OK	Piper	jacquemontianum

TBE04	H 00001RBS	Costaceae	OK	Costus	pulverulentus
TBE04	H 00002RBS	Poaceae	INDET		
TBE04	H 00003RBS	Bromeliaceae	INDET		
TBE04	H 00004RBS	Heliconiaceae	OK	Heliconia	vaginalis
TBE04	H 00005RBS	Araceae	CF	Spathiphyllum	blandum
TBE05	T 00001RBS	Vochysiaceae	OK	Vochysia	hondurensis
TBE05	T 00002RBS	Combretaceae	OK	Terminalia	amazonia
TBE05	T 00003RBS	Moraceae	OK	Ficus	insipida
TBE05	T 00004RBS	Anacardiaceae	OK	Spondias	radlkoferi
TBE05	T 00005RBS	Moraceae	OK	Ficus	insipida
TBE05	T 00006RBS	Burseraceae	OK	Protium	confusum
TBE05	T 00007RBS	Boraginaceae	OK	Cordia	diversifolia
TBE05	T 00008RBS	Fabaceae - Mimosoideae	OK	Inga	cocleensis
TBE05	T 00009RBS	Fabaceae - Faboideae	OK	Ormosia	velutina
TBE05	T 00010RBS	Moraceae	OK	Ficus	maxima
TBE05	T 00011RBS	Salicaceae	OK	Zuelania	guidonia
TBE05	T 00012RBS	Melastomataceae	OK	Miconia	serrulata
TBE05	T 00013RBS	Melastomataceae	OK	Bellucia	grossularioides
TBE05	T 00014RBS	Moraceae	OK	Ficus	maxima
TBE05	T 00015RBS	Moraceae	OK	Castilla	elastica
TBE05	T 00016RBS	Hypericaceae	CF	Vismia	camparaguey
TBE05	T 00017RBS	Sapindaceae	OK	Cupania	belizensis
TBE05	T 00018RBS	Rubiaceae	OK	Morinda	panamensis
TBE05	T 00019RBS	Myristicaceae	OK	Compsoneura	mexicana
TBE05	T 00020RBS	Chrysobalanaceae	OK	Hirtella	guatemalensis
TBE05	T 00021RBS	Chrysobalanaceae	OK	Hirtella	racemosa
TBE05	P 00001RBS	Arecaceae	OK	Bactris	mexicana
TBE05	P 00005RBS	Arecaceae	INDET		
TBE05	P 00002RBS	Arecaceae	OK	Attalea	cohune
TBE05	P 00003RBS	Arecaceae	OK	Astrocaryum	mexicanum
TBE05	P 00004RBS	Arecaceae	OK	Sabal	mauritiiformis
TBE05	F 00001RBS	Pteridaceae	OK	Adiantum	petiolatum
TBE05	F 00002RBS	Thelypteridaceae	CF	Thelypteris	ghiesbreghtii
TBE05	F 00003RBS	Selaginellaceae	OK	Selaginella	umbrosa
TBE05	F 00004RBS	Lygodiaceae	OK	Lygodium	venustum
TBE05	F 00005RBS	Lygodiaceae	OK	Lygodium	venustum
TBE05	V 00001RBS	Araceae	OK	Syngonium	angustatum
TBE05	V 00002RBS	Dilleniaceae	OK	Doliocarpus	dentatus
TBE05	V 00003RBS	Smilacaceae	OK	Smilax	spinosa
TBE05	V 00004RBS	Araceae	CF	Anthurium	pentaphyllum
TBE05	V 00005RBS	Fabaceae - Faboideae	OK	Machaerium	isadelphum
TBE05	V 00006RBS	Fabaceae - Faboideae	OK	Dalbergia	monetaria
TBE05	V 00007RBS	INDET	INDET		
TBE05	V 00008RBS	Araceae	CF	Monstera	tuberculata
TBE05	V 00009RBS	Araceae	CF	Philodendron	radiatum
TBE05	V 00010RBS	Malpighiaceae	INDET		
TBE05	SH 00001RBS	Rubiaceae	CF	Psychotria	poeppigiana

TBE05	SH 00002RBS	Costaceae	CF	Costus	pulverulentus
TBE05	SH 00003RBS	Melastomataceae	OK	Clidemia	capitellata
TBE05	SH 00004RBS	Piperaceae	OK	Piper	jacquemontianum
TBE05	H 00001RBS	Orchidaceae	INDET		
TBE05	H 00002RBS	Heliconiaceae	OK	Heliconia	vaginalis
TBE05	H 00003RBS	Marantaceae	OK	Pleiostachya	pruinosa
TBE05	H 00004RBS		INDET		
TBE05	H 00005RBS	Zingiberaceae	OK	Renealmia	mexicana
TBE05	H 00006RBS	Zamiaceae	CF	Zamia	polymorpha
TBE05	H 00007RBS	Orchidaceae	INDET		
TBE05	H 00008RBS	Poaceae	OK	Pharus	parvifolius
TBE05	V 00011RBS	Sapindaceae	OK	Paullinia	costaricensis
VOL01	T 00001RBS	Moraceae	OK	Pseudolmedia	glabrata
VOL01	T 00002RBS	Euphorbiaceae	OK	Alchornea	latifolia
VOL01	T 00003RBS	Euphorbiaceae	OK	Alchornea	latifolia
VOL01	T 00004RBS	Rutaceae	OK	Zanthoxylum	juniperinum
VOL01	T 00005RBS	Rubiaceae	OK	Alseis	yucatanensis
VOL01	T 00006RBS	Sapindaceae	OK	Matayba	oppositifolia
VOL01	T 00007RBS	Olacaceae	OK	Heisteria	media
VOL01	T 00008RBS	Anacardiaceae	OK	Spondias	radlkoferi
VOL01	T 00009RBS	Burseraceae	OK	Bursera	simaruba
VOL01	T 00010RBS	Chrysobalanaceae	OK	Licania	hypoleuca
VOL01	T 00011RBS	Anacardiaceae	OK	Astronium	graveolens
VOL01	T 00012RBS	Boraginaceae	OK	Cordia	diversifolia
VOL01	T 00013RBS	Bignoniaceae	OK	Tabebuia	chrysantha
VOL01	T 00014RBS	Chrysobalanaceae	OK	Licania	hypoleuca
VOL01	T 00015RBS	Urticaceae	OK	Cecropia	obtusifolia
VOL01	T 00016RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
VOL01	T 00017RBS	Lauraceae	OK	Ocotea	cernua
VOL01	T 00018RBS	Sapindaceae	OK	Matayba	clavelligera
VOL01	T 00019RBS	Moraceae	INDET		
VOL01	T 00020RBS	Malvaceae	OK	Quararibea	funebris
VOL01	T 00021RBS	Combretaceae	OK	Terminalia	amazonia
VOL01	T 00022RBS		INDET		
VOL01	T 00023RBS	Apocynaceae	OK	Aspidosperma	spruceanum
VOL01	T 00024RBS	Rubiaceae	CF	Randia	matudae
VOL01	T 00025RBS	Myrtaceae	OK	Plinia	peroblata
VOL01	T 00026RBS		INDET		
VOL01	T 00027RBS		INDET		
VOL01	T 00028RBS	Melastomataceae	OK	Mouriri	myrtilloides
VOL01	T 00029RBS	Rubiaceae	OK	Alseis	yucatanensis
VOL01	P 00001RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
VOL01	P 00002RBS	Arecaceae	OK	Astrocaryum	mexicanum
VOL01	P 00003RBS	Arecaceae	OK	Bactris	mexicana
VOL01	P 00004RBS	Arecaceae	OK	Cryosophila	stauracantha
VOL01	P 00005RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
VOL01	P 00006RBS	Arecaceae	OK	Desmoncus	orthacanthos

VOL01	F 00001RBS	Thelypteridaceae	INDET	Thelypteris	
VOL01	F 00002RBS	Tectariaceae	OK	Tectaria	rivalis
VOL01	F 00003RBS	Pteridaceae	CF	Adiantum	tetraphyllum
VOL01	F 00004RBS	Dryopteridaceae	OK	Ctenitis	excelsa
VOL01	F 00005RBS	Lygodiaceae	OK	Lygodium	heterodoxum
VOL01	V 00001RBS	Fabaceae - Mimosoideae	CF	Entada	rheedei
VOL01	V 00002RBS	Araceae	OK	Philodendron	hederaceum
VOL01	V 00003RBS	Bignoniaceae	OK	Amphilophium	paniculatum
VOL01	V 00004RBS	Araceae	CF	Monstera	acuminata
VOL01	V 00005RBS	Euphorbiaceae	CF	Dalechampia	schottii
VOL01	V 00006RBS	Araceae	CF	Syngonium	angustatum
VOL01	V 00007RBS	Araceae	INDET	Monstera	
VOL01	V 00008RBS	Araceae	OK	Philodendron	inaequilaterum
VOL01	V 00009RBS	Araceae	CF	Anthurium	pentaphyllum
VOL01	V 00010RBS	Apocynaceae	INDET		
VOL01	V 00011RBS	Dilleniaceae	OK	Tetracera	volubilis
VOL01	V 00012RBS	Araceae	CF	Spathiphyllum	
VOL01	V 00013RBS		INDET		
VOL01	H 00001RBS	Marantaceae	OK	Pleiostachya	pruinosa
VOL01	H 00002RBS	Piperaceae	OK	Piper	jacquemontianum
VOL01	H 00003RBS	Melastomataceae	OK	Clidemia	hirta
VOL01	H 00004RBS	Araceae	CF	Spathiphyllum	blandum
VOL01	H 00005RBS	Piperaceae	OK	Piper	neesianum
VOL01	H 00006RBS	Piperaceae	OK	Piper	neesianum
VOL01	SH 00001RBS	Piperaceae	OK	Piper	neesianum
VOL01	F 00006RBS	Selaginellaceae	OK	Selaginella	umbrosa
VOL01	V 00014RBS	Bignoniaceae	CF	Mansoa	kerere
VOL01	H 00007RBS	Marantaceae	OK	Maranta	arundinacea
VOL02	T 00001RBS		INDET		
VOL02	T 00002RBS	Boraginaceae	OK	Cordia	diversifolia
VOL02	T 00003RBS	Malvaceae	OK	Pachira	aquatica
VOL02	T 00004RBS	Anacardiaceae	OK	Astronium	graveolens
VOL02	T 00005RBS	Rhizophoraceae	OK	Cassipourea	guianensis
VOL02	T 00006RBS	Chrysobalanaceae	OK	Licania	hypoleuca
VOL02	T 00007RBS	Euphorbiaceae	OK	Hieronyma	alchorneoides
VOL02	T 00008RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
VOL02	T 00009RBS	Fabaceae - Faboideae	OK	Acosmium	panamense
VOL02	T 00010RBS	Burseraceae	OK	Protium	confusum
VOL02	T 00011RBS	Malvaceae	OK	Trichospermum	mexicanum
VOL02	T 00012RBS	Vochysiaceae	OK	Vochysia	hondurensis
VOL02	T 00013RBS	Rutaceae	CF	Zanthoxylum	ekmanii
VOL02	T 00014RBS	Rubiaceae	OK	Stenostomum	lucidum
VOL02	T 00015RBS	Anacardiaceae	OK	Spondias	radlkoferi
VOL02	T 00016RBS	Meliaceae	OK	Swietenia	macrophylla
VOL02	T 00017RBS	Fabaceae - Mimosoideae	OK	Inga	edulis
VOL02	T 00018RBS	Euphorbiaceae	OK	Croton	schiedeanus
VOL02	T 00019RBS	Salicaceae	OK	Casearia	commersoniana

VOL02	T 00020RBS	Myristicaceae	OK	Compsoneura	mexicana
VOL02	T 00021RBS	Rubiaceae	OK	Posoqueria	latifolia
VOL02	P 00001RBS	Arecaceae	OK	Sabal	mauritiiformis
VOL02	P 00002RBS	Arecaceae	OK	Attalea	cohune
VOL02	P 00003RBS	Arecaceae	OK	Astrocaryum	mexicanum
VOL02	P 00004RBS	Arecaceae	OK	Bactris	mexicana
VOL02	P 00005RBS	Arecaceae	OK	Desmoncus	orthacanthos
VOL02	P 00006RBS	Arecaceae	OK	Cryosophila	stauracantha
VOL02	F 00001RBS		INDET		
VOL02	F 00002RBS	Pteridaceae	OK	Adiantum	latifolium
VOL02	F 00004RBS	Selaginellaceae	OK	Selaginella	umbrosa
VOL02	V 00001RBS	Fabaceae - Mimosoideae	CF	Entada	rheedii
VOL02	V 00002RBS	Araceae	CF	Monstera	tuberculata
VOL02	V 00003RBS	Euphorbiaceae	CF	Dalechampia	schottii
VOL02	V 00004RBS	Bignoniaceae	OK	Martinella	obovata
VOL02	V 00005RBS	Bignoniaceae	CF	Mansoa	kerere
VOL02	V 00006RBS	Araceae	CF	Philodendron	inaequilaterum
VOL02	V 00007RBS	Araliaceae	OK	Dendropanax	arboreus
VOL02	V 00008RBS	Sapindaceae	INDET		
VOL02	V 00009RBS	Araceae	INDET	Monstera	
VOL02	V 00010RBS	Araceae	CF	Philodendron	radiatum
VOL02	V 00011RBS	Araceae	CF	Monstera	acuminata
VOL02	SH 00001RBS	Piperaceae	OK	Piper	jacquemontianum
VOL02	SH 00002RBS	Piperaceae	OK	Piper	neesianum
VOL02	SH 00003RBS	Melastomataceae	OK	Clidemia	hirta
VOL02	SH 00004RBS	Melastomataceae	OK	Miconia	insularis
VOL02	SH 00005RBS	Rubiaceae	INDET		
VOL02	H 00001RBS	Costaceae	OK	Costus	pulverulentus
VOL02	H 00002RBS	Poaceae	CF	Olyra	latifolia
VOL02	H 00003RBS	Marantaceae	OK	Maranta	arundinacea
VOL02	F 00003RBS	Lomariopsidaceae	OK	Nephrolepis	biserrata
VOL02	L 00001RBS	Celastraceae	OK	Cheiloclinium	belizense
VOL02	V 00012RBS	Asteraceae	OK	Mikania	pyramidata
VOL02	V 00013RBS	Araceae	CF	Anthurium	microspadix
VOL02	V 00014RBS	Rubiaceae	OK	Mitracarpus	linearifolius
VOL03	T 00001RBS	Moraceae	OK	Brosimum	alicastrum
VOL03	T 00002RBS	Malvaceae	OK	Trichospermum	grewiifolium
VOL03	T 00003RBS		INDET		
VOL03	T 00004RBS		INDET		
VOL03	T 00005RBS	Boraginaceae	CF	Cordia	alliodora
VOL03	T 00006RBS	Boraginaceae	OK	Cordia	diversifolia
VOL03	T 00007RBS	Apocynaceae	OK	Aspidosperma	spruceanum
VOL03	T 00008RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
VOL03	T 00009RBS	Fabaceae - Mimosoideae	OK	Cojoba	arborea
VOL03	T 00010RBS	Olacaceae	OK	Heisteria	media
VOL03	T 00011RBS		INDET		
VOL03	T 00012RBS	Lauraceae	OK	Nectandra	cuspidata

VOL03	T 00013RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
VOL03	T 00014RBS	Rutaceae	OK	Zanthoxylum	ekmanii
VOL03	T 00015RBS	Meliaceae	OK	Swietenia	macrophylla
VOL03	T 00016RBS	Vochysiaceae	OK	Vochysia	hondurensis
VOL03	T 00017RBS	Fabaceae	OK	Senegalia	polyphylla
VOL03	T 00018RBS	Rubiaceae	OK	Alseis	yucatanensis
VOL03	T 00019RBS	Lauraceae	OK	Licaria	peckii
VOL03	T 00020RBS	Fabaceae - Faboideae	OK	Acosmium	panamense
VOL03	T 00021RBS	Moraceae	INDET		
VOL03	P 00001RBS	Arecaceae	OK	Astrocaryum	mexicanum
VOL03	P 00002RBS	Arecaceae	CF	Chamaedorea	tepejilote
VOL03	P 00003RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
VOL03	P 00004RBS	Arecaceae	OK	Reinhardtia	latisecta
VOL03	P 00005RBS	Arecaceae	OK	Attalea	cohune
VOL03	P 00006RBS	Arecaceae	OK	Astrocaryum	mexicanum
VOL03	P 00007RBS	Arecaceae	OK	Bactris	mexicana
VOL03	P 00008RBS	Arecaceae	OK	Sabal	mauritiiformis
VOL03	P 00009RBS	Arecaceae	OK	Chamaedorea	tepejilote
VOL03	F 00007RBS	Selaginellaceae	OK	Selaginella	umbrosa
VOL03	F 00001RBS		INDET		
VOL03	F 00002RBS	Pteridaceae	OK	Adiantum	petiolatum
VOL03	F 00003RBS	Lomariopsidaceae	OK	Lomariopsis	vestita
VOL03	F 00004RBS	Pteridaceae	CF	Adiantum	tetraphyllum
VOL03	F 00005RBS	Tectariaceae	OK	Dictyoxiphium	panamense
VOL03	F 00006RBS		INDET		
VOL03	H 00005RBS	Cactaceae	OK	Pseudorhipsalis	ramulosa
VOL03	V 00001RBS	Araceae	OK	Anthurium	scandens
VOL03	V 00002RBS	Bignoniaceae	CF	Martinella	obovata
VOL03	V 00003RBS	Araceae	INDET		
VOL03	V 00004RBS	Araceae	CF	Spathiphyllum	blandum
VOL03	V 00005RBS	Araceae	INDET	Monstera	
VOL03	V 00006RBS	Araceae	CF	Anthurium	scandens
VOL03	V 00007RBS	Araceae	CF	Monstera	tuberculata
VOL03	V 00008RBS	Sapindaceae	OK	Paullinia	glomerulosa
VOL03	V 00009RBS	Pteridaceae	OK	Anetium	citrifolium
VOL03	H 00001RBS		INDET		
VOL03	H 00002RBS	Marantaceae	OK	Maranta	arundinacea
VOL03	H 00003RBS	Marantaceae	OK	Maranta	arundinacea
VOL03	T 00022RBS	Rubiaceae	INDET		
VOL03	T 00023RBS	Piperaceae	INDET	Piper	
VOL03	H 00004RBS	Costaceae	OK	Costus	pulverulentus
VOL03	SH 00001RBS	Rubiaceae	CF	Psychotria	mexiae
VOL03	SH 00002RBS	Piperaceae	OK	Piper	villiramulum
VOL03	V 00011RBS	Sapindaceae	OK	Paullinia	glomerulosa
VOL03	V 00012RBS	Araceae	CF	Anthurium	pentaphyllum
VOL03	V 00013RBS	Araceae	CF	Anthurium	microspadix
VOL03	V 00014RBS	Apocynaceae	OK	Mandevilla	hirsuta

VOL03	V 00010RBS	Araceae	INDET	Philodendron	
VOL03	V 00015RBS	Bignoniaceae	INDET		
VOL04	T 00001RBS	Anacardiaceae	OK	Astronium	graveolens
VOL04	T 00002RBS	Malvaceae	OK	Pachira	aquatica
VOL04	T 00003RBS	Bignoniaceae	OK	Tabebuia	chrysantha
VOL04	T 00004RBS	Chrysobalanaceae	OK	Licania	hypoleuca
VOL04	T 00005RBS	Malvaceae	OK	Luehea	speciosa
VOL04	T 00006RBS	Burseraceae	OK	Bursera	simaruba
VOL04	T 00007RBS	Moraceae	OK	Pseudolmedia	spuria
VOL04	T 00008RBS	Fabaceae - Faboideae	OK	Dalbergia	stevensonii
VOL04	T 00009RBS	Sapotaceae	OK	Manilkara	zapota
VOL04	T 00010RBS	Rhizophoraceae	OK	Cassipourea	guianensis
VOL04	T 00011RBS	Rubiaceae	OK	Morinda	panamensis
VOL04	T 00012RBS	Polygonaceae	OK	Coccoloba	tuerckheimii
VOL04	T 00013RBS		INDET		
VOL04	T 00014RBS	Rubiaceae	OK	Faramea	occidentalis
VOL04	T 00015RBS	Melastomataceae	OK	Mouriri	exilis
VOL04	T 00016RBS	Salicaceae	OK	Casearia	tremula
VOL04	T 00017RBS	Myrtaceae	OK	Myrciaria	floribunda
VOL04	T 00018RBS	Myrtaceae	OK	Myrcia	splendens
VOL04	P 00001RBS	Arecaceae	OK	Cryosophila	stauracantha
VOL04	P 00002RBS	Arecaceae	OK	Attalea	cohune
VOL04	P 00003RBS	Arecaceae	OK	Astrocaryum	mexicanum
VOL04	P 00004RBS	Arecaceae	OK	Desmoncus	orthacanthos
VOL04	P 00005RBS	Arecaceae	OK	Sabal	mauritiiformis
VOL04	P 00006RBS	Arecaceae	OK	Bactris	mexicana
VOL04	F 00001RBS	Lygodiaceae	OK	Lygodium	heterodoxum
VOL04	V 00001RBS	Araceae	CF	Philodendron	hederaceum
VOL04	V 00002RBS	Menispermaceae	OK	Abuta	panamensis
VOL04	V 00003RBS	Araceae	CF	Monstera	tuberculata
VOL04	V 00004RBS	Malpighiaceae	INDET		
VOL04	V 00005RBS	Sapindaceae	OK	Serjania	lundellii
VOL04	V 00006RBS	Bignoniaceae	OK	Amphilophium	paniculatum
VOL04	V 00007RBS	Fabaceae - Faboideae	CF	Dalbergia	brownei
VOL04	V 00008RBS	Smilacaceae	OK	Smilax	mollis
VOL04	V 00009RBS	Dioscoreaceae	OK	Dioscorea	densiflora
VOL04	V 00010RBS	Fabaceae - Mimosoideae	CF	Entada	rheedei
VOL04	T 00019RBS	Piperaceae	CF	Piper	neesianum
VOL04	SH 00001RBS	Piperaceae	CF	Piper	neesianum
VOL04	H 00001RBS	Orchidaceae	INDET		
VOL04	H 00002RBS	Zamiaceae	CF	Zamia	polymorpha
VOL04	H 00003RBS	Tectariaceae	OK	Tectaria	heracleifolia
VOL04	H 00004RBS	Costaceae	OK	Costus	pulverulentus
VOL04	F 00002RBS	Lygodiaceae	OK	Lygodium	heterodoxum
VOL04	L 00001RBS	Fabaceae	INDET		
VOL04	SH 00002RBS	Rubiaceae	CF	Psychotria	acuminata
VOL04	T 00019RBS	Fabaceae - Mimosoideae	OK	Cojoba	graciliflora

VOL04	L 00004RBS	Fabaceae - Faboideae	OK	Machaerium	kegelii
VOL05	T 00001RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
VOL05	T 00002RBS	Moraceae	OK	Brosimum	alicastrum
VOL05	T 00003RBS	Anacardiaceae	OK	Spondias	radlkoferi
VOL05	T 00004RBS		INDET		
VOL05	T 00005RBS	Euphorbiaceae	OK	Alchornea	latifolia
VOL05	T 00006RBS	Rhizophoraceae	OK	Cassipourea	guianensis
VOL05	T 00007RBS	Apocynaceae	OK	Aspidosperma	spruceanum
VOL05	T 00008RBS	Fabaceae - Faboideae	OK	Vatairea	lundellii
VOL05	T 00009RBS	Bignoniaceae	OK	Tabebuia	chrysantha
VOL05	T 00010RBS	Meliaceae	OK	Guarea	glabra
VOL05	T 00011RBS	Salicaceae	OK	Zuelania	guidonia
VOL05	T 00012RBS	Sapotaceae	OK	Pouteria	sapota
VOL05	T 00013RBS	Olacaceae	OK	Heisteria	media
VOL05	T 00014RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
VOL05	T 00015RBS	Meliaceae	OK	Swietenia	macrophylla
VOL05	T 00016RBS	Boraginaceae	CF	Cordia	diversifolia
VOL05	T 00017RBS	Myrtaceae	OK	Myrcia	splendens
VOL05	T 00018RBS	Fabaceae - Mimosoideae	OK	Cojoba	arborea
VOL05	T 00019RBS	Apocynaceae	OK	Aspidosperma	megalocarpon
VOL05	T 00020RBS	Vochysiaceae	OK	Vochysia	hondurensis
VOL05	T 00021RBS	Moraceae	OK	Ficus	velutina
VOL05	T 00022RBS	Fabaceae	OK	Senegalia	polyphylla
VOL05	T 00023RBS	Boraginaceae	INDET	Cordia	
VOL05	T 00024RBS	Annonaceae	CF	Annona	mucosa
VOL05	T 00025RBS	Moraceae	INDET	Ficus	
VOL05	P 00001RBS	Arecaceae	OK	Chamaedorea	neurochlamys
VOL05	P 00002RBS	Arecaceae	OK	Bactris	mexicana
VOL05	P 00003RBS	Arecaceae	OK	Attalea	cohune
VOL05	P 00004RBS	Arecaceae	OK	Astrocaryum	mexicanum
VOL05	P 00005RBS	Arecaceae	OK	Sabal	mauritiiformis
VOL05	P 00006RBS	Arecaceae	OK	Cryosophila	stauracantha
VOL05	P 00007RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
VOL05	P 00008RBS	Arecaceae	OK	Desmoncus	orthacanthos
VOL05	F 00001RBS	Lygodiaceae	OK	Lygodium	heterodoxum
VOL05	F 00002RBS	Lomariopsidaceae	OK	Lomariopsis	recurvata
VOL05	F 00003RBS	Pteridaceae	OK	Adiantum	pulverulentum
VOL05	F 00004RBS	Selaginellaceae	OK	Selaginella	umbrosa
VOL05	L 00001RBS	Combretaceae	INDET	Combretum	
VOL05	L 00002RBS	Bignoniaceae	CF	Callichlamys	latifolia
VOL05	V 00001RBS	Araceae	CF	Spathiphyllum	blandum
VOL05	V 00002RBS	Araceae	INDET	Monstera	
VOL05	V 00003RBS	Araceae	CF	Philodendron	hederaceum
VOL05	V 00005RBS	Araceae	CF	Anthurium	scandens
VOL05	V 00007RBS	Passifloraceae	OK	Passiflora	biflora
VOL05	V 00008RBS	Combretaceae	INDET	Combretum	
VOL05	V 00009RBS	Araceae	CF	Philodendron	inaequilaterum

VOL05	V 00010RBS	Meliaceae	INDET	Guarea	
VOL05	V 00011RBS	Bignoniaceae	OK	Amphilophium	paniculatum
VOL05	V 00012RBS	Rubiaceae	CF	Oldenlandia	corymbosa
VOL05	V 00006RBS	Araceae	INDET		
VOL05	H 00001RBS	Poaceae	OK	Pharus	parvifolius
VOL05	H 00002RBS	Marantaceae	OK	Pleiostachya	pruinosa
VOL05	H 00003RBS	Marantaceae	OK	Maranta	arundinacea
VOL05	H 00004RBS	Costaceae	CF	Costus	pictus
VOL05	L 00003RBS	Fabaceae - Faboideae	OK	Machaerium	floribundum
VOL05	F 00001RBS	Thelypteridaceae	INDET	Thelypteris	
VOL05	V 00010RBS	Apocynaceae	INDET		
VOL05	V 00009RBS	Apocynaceae	INDET		
VOL06	T 00001RBS	Fabaceae - Faboideae	OK	Vatairea	lundellii
VOL06	T 00002RBS		INDET		
VOL06	T 00003RBS	Sapotaceae	OK	Pouteria	izabalensis
VOL06	T 00004RBS	Myristicaceae	OK	Virola	koschnyi
VOL06	T 00005RBS	Chrysobalanaceae	OK	Licania	hypoleuca
VOL06	T 00006RBS	Boraginaceae	OK	Cordia	alliodora
VOL06	T 00007RBS	Apocynaceae	OK	Stemmadenia	donnell-smithii
VOL06	T 00008RBS		INDET		
VOL06	T 00009RBS	Chrysobalanaceae	OK	Licania	sparsipilis
VOL06	T 00010RBS	Fabaceae - Faboideae	OK	Pterocarpus	rohrii
VOL06	T 00011RBS	Ulmaceae	OK	Ampelocera	hottlei
VOL06	T 00012RBS	Melastomataceae	INDET		
VOL06	T 00013RBS	Euphorbiaceae	OK	Alchornea	latifolia
VOL06	T 00014RBS	Melastomataceae	OK	Mouriri	myrtilloides
VOL06	T 00015RBS	Bignoniaceae	OK	Tabebuia	chrysantha
VOL06	T 00016RBS	Fabaceae - Caesalpinioideae	OK	Dialium	guianense
VOL06	T 00017RBS		INDET		
VOL06	T 00018RBS	Urticaceae	OK	Cecropia	obtusifolia
VOL06	T 00019RBS	Salicaceae	OK	Casearia	arborea
VOL06	T 00020RBS	Sapotaceae	OK	Pouteria	izabalensis
VOL06	T 00021RBS	Fabaceae	OK	Senegalia	polyphylla
VOL06	T 00022RBS	Rubiaceae	OK	Posoqueria	latifolia
VOL06	T 00023RBS	Euphorbiaceae	OK	Alchornea	latifolia
VOL06	T 00024RBS	Rhizophoraceae	OK	Cassipourea	guianensis
VOL06	T 00025RBS	Sapindaceae	OK	Cupania	scrobiculata
VOL06	T 00026RBS	Burseraceae	OK	Protium	confusum
VOL06	T 00027RBS	Apocynaceae	OK	Aspidosperma	spruceanum
VOL06	T 00028RBS	Urticaceae	OK	Cecropia	peltata
VOL06	T 00029RBS		INDET		
VOL06	T 00030RBS	Melastomataceae	OK	Mouriri	exilis
VOL06	T 00031RBS	Clusiaceae	OK	Garcinia	intermedia
VOL06	T 00032RBS	Calophyllaceae	OK	Calophyllum	brasiliense
VOL06	T 00033RBS	Melastomataceae	OK	Miconia	elata
VOL06	T 00034RBS	Quiinaceae	OK	Quiina	schippii
VOL06	P 00001RBS	Arecaceae	OK	Chamaedorea	neurochlamys

VOL06	P 00002RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
VOL06	P 00003RBS	Arecaceae	OK	Reinhardtia	latisecta
VOL06	P 00004RBS	Arecaceae	INDET		
VOL06	P 00005RBS	Arecaceae	OK	Euterpe	precatoria
VOL06	P 00006RBS	Arecaceae	OK	Attalea	cohune
VOL06	P 00007RBS	Arecaceae	OK	Cryosophila	stauracantha
VOL06	P 00008RBS	Arecaceae	OK	Astrocaryum	mexicanum
VOL06	P 00009RBS	Arecaceae	OK	Bactris	mexicana
VOL06	P 00010RBS	Arecaceae	OK	Chamaedorea	ernesti-augusti
VOL06	P 00011RBS	Arecaceae	OK	Desmoncus	orthacanthos
VOL06	F 00001RBS	Lygodiaceae	INDET	Lygodium	
VOL06	F 00002RBS		INDET		
VOL06	F 00003RBS	Dryopteridaceae	OK	Polybotrya	caudata
VOL06	F 00004RBS	Pteridaceae	OK	Pteris	grandifolia
VOL06	F 00005RBS	Hymenophyllaceae	CF	Trichomanes	diversifrons
VOL06	F 00006RBS	Tectariaceae	OK	Dictyoxiphium	panamense
VOL06	F 00007RBS	Marattiaceae	OK	Danaea	elliptica
VOL06	F 00008RBS	Pteridaceae	OK	Adiantum	tetraphyllum
VOL06	F 00009RBS	Hymenophyllaceae	CF	Trichomanes	collariatum
VOL06	V 00001RBS	Araceae	CF	Monstera	tuberculata
VOL06	V 00002RBS	Araceae	INDET		
VOL06	V 00003RBS	Araceae	INDET	Philodendron	
VOL06	V 00004RBS	Araceae	INDET	Anthurium	
VOL06	V 00005RBS	Araceae	CF	Anthurium	scandens
VOL06	V 00006RBS		INDET		
VOL06	V 00007RBS	Araceae	CF	Philodendron	inaequilaterum
VOL06	V 00008RBS	Sapindaceae	OK	Paullinia	costaricensis
VOL06	H 00001RBS	Poaceae	OK	Pharus	parvifolius
VOL06	H 00002RBS	Rubiaceae	INDET	Psychotria	
VOL06	H 00003RBS	Araceae	CF	Spathiphyllum	blandum
VOL06	H 00004RBS	Marantaceae	OK	Pleiostachya	pruinosa
VOL06	H 00005RBS		INDET		
VOL06	H 00006RBS	Costaceae	CF	Costus	pulverulentus
VOL06	SH 00001RBS	Piperaceae	OK	Piper	jacquemontianum
VOL06	F 00010RBS	Selaginellaceae	OK	Selaginella	umbrosa
VOL06	L 00001RBS	Dilleniaceae	OK	Davilla	nitida
VOL06	GLH00002RBS	Commelinaceae	OK	Commelina	diffusa