Recommended Species for Rain Gardens, Bioswales, and Bioretention Cells in Puerto Rico and the Caribbean Islands

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INTRODUCTION

The last decade has seen a revolution in landscape architecture and urban design, with an ever increasing emphasis on an eco-functionalist view of the city (and urbanization in general) and a post-conservationist view of nature that values the contribution of biological organisms to city life (Forman 2014; Terrasa-Soler 2014, 2016). Green infrastructure is one of the main tools of the landscape architect in the design of the *ecological city* and in retrofitting old patches of city fabric for increased urban resiliency (Terrasa-Soler et al. 2015; Terrasa-Soler 2016). For **green infrastructure** it is meant any system that performs an urban function (transportation, waste removal, temperature control, removal of air pollutants, power generation, stormwater management, etc.) in which active biological organisms participate, and that generates multiple benefits. In contrast, ordinary infrastructure (or gray infrastructure) always performs a single function (Terrasa-Soler 2016).

Green infrastructure is increasingly being recognized as a key to improve the overall urban experience and as a multi-valent landscape intervention that provides benefits well beyond the mere aspect of stormwater management (EPA 2015; Terrasa-Soler et al. 2015). As such, green infrastructure provides a long list of benefits – ecological, spatial, social, cultural, and aesthetic – that contribute to the development of livable and resilient cities. It is also an important tool for developing adaptation plans for global climate change. Coastal green infrastructure, for example, has the potential to increase coastal resiliency to changes in sea level and storm intensity. Resiliency to changing patterns in drought and flood cycles is also a potential benefit of green infrastructure.

Green infrastructure, even when designed primarily for stormwater management, should also perform other functions, especially if it is to be constructed in urban areas. The plant palette, for example, should be selected with care to enhance local and regional biodiversity and improve urban space. It is not merely an issue of "aesthetics" or the "looks-good" factor, it is indeed a matter of urban functioning, circulation, spatial design, and the overall design of urban fabric. This is why green infrastructure in the city, and as a tool for the resilient city, is not just a subject for engineers, but should be a main concern of landscape architects and urban designers in the quest to achieve a better urban environment.

Green infrastructure designed primarily for stormwater management comes in a variety of flavors. The general goal, however, is to enhance or improve the performance of the hydrological cycle in urbanized lands. This is done by using a variety of design strategies that might include:

- Capturing and reusing part of the rainwater;
- Increasing evapotranspiration and infiltration, by increasing plant coverage, improving soil performance, and reducing impermeable surfaces;

- Hydrologically "disconnecting" or disaggregating small parcels of land or surfaces, such that generated stormwater is dealt with at the most local context possible and not collected and dumped far away; and,
- Attenuating peak flows through longer flow paths and increased storage capacity.

All of these design strategies might also help to reduce stormwater pollution, which may be the main design goal, and if it is, special consideration is then given to flow paths and biological components that might enhance the pollution abatement function of the landscape intervention.

Water-focused green infrastructure, thus, can present different typologies based on which of these aforementioned strategies is emphasized. Oftentimes, however, a combination of green infrastructure typologies is used to achieve all of the design objectives of a particular project. Common water-focused green infrastructure typologies include green roofs, rain gardens, bioswales, bioretention cells, and constructed wetlands.

Rain gardens, bioswales, and bioretention cells are usually grouped together because of their similar design and performance characteristics. They all capture significant amounts of water (usually the first 0.5-1.0 inches [13-26 mm] of a rainstorm) and rely on rapid infiltration, evapotranspiration, and limited storage as their main hydrologic functions. The main difference between them is that rain gardens do not include an underdrain system while bioswales and bioretention cells do. Bioswales are primarily narrow interventions that are easy to accommodate in most sites and that usually convey overflows to an existing drain system. Bioretention cells, on the other hand, are not linear, occupy a specific area, such as the buffer zone between a parking lot and a small stream, and generally have deeper engineered soils and trees.

Rain gardens, bioswales, and bioretention cells have the potential of contributing to local and regional biodiversity if location, shape, and plant palette are well-designed. These interventions can become "stepping stones" between larger patches of urban habitat, and thus contribute also to the ecological functioning of cities (Dramstad et al. 1996; Forman 2014). They can become amenities in community parks and enhance the design of parking lots, for example. Bioswales in urban streets can also help articulate urban space and reduce noise, heat, and air pollution from vehicles.

All of these multiple benefits of rain gardens, bioswales, and bioretention cells in cities depend to a large degree on the plant palette selected. In tropical regions in general and in the Caribbean Region in particular, however, there has been very little research as to which species perform best when used in rain gardens and bioswales/bioretention cells. There are a few publications directed to the homeowner (see for example USDA 2012 and Cullison, nd), but I am not aware of any survey of Caribbean plants recommended for green infrastructure interventions. This paper attempts to remedy this situation by recommending plants suitable for rain gardens, bioswales, and bioretention cells in the Caribbean Region. These three types of green infrastructure are generally easy to build, do not require a great investment, can be scaled to almost any situation, and have the potential for great environmental, social, and cultural benefits. In the Caribbean Islands, where a beautiful and healthy coastal environment is essential for the region's economy, modest green infrastructure interventions could go a long way in protecting the coastal environment from increased development pressures and improving the urban quality of existing cities and towns (see Terrasa-Soler et al. 2015).

METHODOLOGY

To develop the recommended species list for rain gardens, bioswales, and bioretention cells in the Caribbean Region, the following methodology was used:

1. As a base list, the United States Army Corps of Engineers (USACE) National Wetland Plant List – Caribbean Region was used (USACE 2014). Only Facultative wetland plants (FAC) and Facultative-Upland wetland plants (FACU) were used initially. Those categories are defined as follows:

    a. FAC = Plants that occur in wetlands and non-wetlands;

    b. FACU = Plants that usually occur in non-wetlands, but may occur in wetlands (USACE 2014.

    The reasoning behind using these plants in particular is that rain gardens, bioswales, and bioretention cells are intended to drain completely in 24-36 hours; they are not intended to become wetlands, where inundation for some extended period of time is expected. Therefore, the plants selected for these types of green infrastructure must tolerate short periods of inundation separated by longer dry periods. Obligate (OBL) wetland plants require long periods of inundation and hydric soils. Soils for bioswales and bioretention cells are specifically designed to be well-drained soils, whose function is in part to enhance water infiltration into the surrounding soils. Some plants from other categories (OBL, FACW, and UPL) were added if there was evidence in the literature cited that they were successfully used in rain gardens, bioswales, and bioretention cells or that they might be suitable for those ecological conditions.

2. From the base list created, plants **native** to the Islands of Puerto Rico and the Caribbean Region were selected, as well as plants that are more commonly available in the nursery trade in the Caribbean even though they might be introduced to the region. The preference for native species derives from their presumed adaptability to local soils and other environmental conditions and from their higher contribution to ecological functioning (better suitable to serve as shelter and food to native wildlife, etc.).

3. Plant scientific names and common English names, as well as other characteristics, were verified in the US Department of Agriculture PLANTS Database (USDA 2016; see http://plants.usda.gov/).

4. Common Spanish names and preferred habitat were verified in Liogier and Martorell (2000).

5. Planting notes, planting specifications, and landscape use recommendations were verified in Hicks (2013) and Schubert (1979), where available, and supplemented by personal observations by the author.

RECOMMENDED SPECIES

The resulting list of recommended plant species for rain gardens, bioswales, and bioretention cells in the Caribbean includes a total of 87 species (see Appendix A). The following tables describe their distribution among various classes.

Table 1. Distribution of recommended species by habit.

HABIT	NUMBER OF RECOMMENDED SPECIES	Percent
Fern	1	1.1
Vine	3	3.5
Forb	39	44.8
Graminoid	15	17.3
Shrub	10	11.5
Shrub/Tree	6	6.9
Tree	11	12.6
Palm	2	2.3
TOTAL	***87***	***100***

Table 2. Distribution of recommended species by wetland status (USACE 2014).

WETLAND STATUS	NUMBER OF RECOMMENDED SPECIES	Percent
OBL	3	3.5
FACW	7	8.0
FAC	31	35.6
FACU	36	41.4
UPL	10	11.5
TOTAL	***87***	***100***

Table 3. Distribution of recommended species by origin with respect to the Islands of Puerto Rico.

ORIGIN	NUMBER OF RECOMMENDED SPECIES	Percent
Native	61	70.1
Introduced	26	29.9
TOTAL	***87***	***100***

CONCLUSIONS AND RECOMMENDATIONS

The work described herein produced a list of 87 species recommended for use in the design of rain gardens, bioswales, and bioretention cells in the Caribbean Islands. Plant palette selection for green infrastructure projects in the world tropics is an area of ongoing research that still needs significant work. Recommended technical specifications for the soils, topographic profiles, and hydraulic structures for water-focused green infrastructure in the tropics are now found in several publications (see for example NOAA 2014); however, recommendations regarding the plant palette are almost non-existent. This publication is intended as a useful starting point.

The landscape architect in charge of the design of a green infrastructure project must independently verify the information contained herein, take this list only as a starting point for palette design, and make their design decisions based on the complete set of conditions for a project. Many other factors, including site-specific factors and urban context, must be taken into account by the landscape architect before a final plant palette is selected. It is hoped that many future green infrastructure projects in the Caribbean Islands are not only designed and constructed, but also evaluated and their results published. Design research is the only way through which we can advance urban and landscape design in our islands, improve the total human environment, and protect the environment of our wildlife for generations to come.

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APPENDIX A. Complete List of Recommended Species

Scientific Name*	Common Names	Habit	Recommended Specification	Species Notes *(wetland status, origin, other notes)*
Alpinia purpurata	Red ginger	Forb	3 gal – 18" ht/min 5 canes/full – 24" oc	UPL, Introduced, prefers moist conditions but well-drained soils, ComAvail
Alpinia zerumbet	Shell ginger	Forb	3 gal – 30" ht/min 5 canes/full – 24" oc	FACU, Introduced, ComAvail
Alternanthera ficoidea	Sanguinaria	Forb	4" pot – 4" ht/full – 18" oc	FACU, Native
Andropogon bicornis	Barbas de indio	Gram.	1 gal – 12" ht/full – 18" oc	FAC, Native
Arachis repens	Maní	Forb	4" pot – fully rooted/full – 12" oc	UPL, Introduced, ComAvail, Potential for stabilizing slopes outside basin bottom, Fixes nitrogen
Bidens pilosa	Spanish needle, Margarita	Forb	4" pot – fully rooted/full – 12" oc	FACU, Introduced
Bougainvillea glabra	Bougainvillea, Trinitaria	Shrub	3 gal – 8" ht x 12" spr/full – 36" oc	UPL, Introduced, attractive purple flowers, adaptable to various conditions. In locations with excessive water they grow prolifically with reduced blooms (Hicks)
Buchnera americana	American bluehearts	Forb	4" pot – fully rooted/full – 12" oc	FACU, Native
Bucida buceras	Gregorywood, Gregre, Úcar	Tree	15 gal – 8' ht/single trunk standard/full	FACU, Native, tall tree, ComAvail
Byrsonima spicata	Doncella, Maricao	Tree	7 gal – 6' ht/full	FACU, Native, Moist environs
Callisia monandra	Cohítre morado	Forb	4" pot – fully rooted/full – 12" oc	FACU, Native
Callisia repens	Creeping inchplant, Cohítre enano	Forb	4" pot – fully rooted/full – 12" oc	FACU, Native

Scientific Name*	**Common Names**	**Habit**	**Recommended Specification**	**Species Notes** *(wetland status, origin, other notes)*
Calophyllum antillanum	Antilles calophyllum, María	Tree	15 gal – 10’ ht/single trunk/full	FAC, Native, ComAvail
Canna indica	Indianshot, Lirio cana	Forb	1 gal – 12” ht/full – 18” oc	FAC, Introduced, attractive flowers
Canna jaegeriana	Caribbean canna	Forb	1 gal – 12” ht/full – 18” oc	FAC, Native
Chamaesyce mesembrianthemifolia	Coastal beach sandmat	Forb	4” pot – fully rooted/full – 12” oc	FAC, Native
Chamaesyce prostrata	Prostrate sandmat, Lechecillo	Forb	4” pot – fully rooted/full – 12” oc	FAC, Native
Chloris spp.	Windmill grass, Horquetilla	Gram.	1 gal – 12” ht/full – 18” oc	FACU, Native
Chrysobalanus icaco	Coco plum, Icaco	Shrub	3 gal – 18” ht/full – 24” oc	FAC, Native, ComAvail
Cladium mariscus ssp. jamaicense	Jamaica swamp sawgrass, Cortadera de ciénaga	Gram.	3 gal – 24” ht/min 5 stems/full – 36" oc	OBL, Native, Requires regularly inundated site
Clusia rosea	Scotch attorney, Autograph tree, Cupey	Tree	15 gal – 6’ ht/full	FACU, Native, ComAvail
Coccoloba uvifera	Seagrape, Uva de playa	Shrub/Tree	3 gal – 24” ht x 12” spr/full – 30” oc	FACU, Native, ComAvail
Cocos nucifera	Palma de coco	Palm	10 gal – 6’ OA/min 7 fronds/full	FACU, Introduced, ComAvail
Codiaeum variegatum	Garden croton, Croton de jardín	Shrub	1 gal – 12” ht/full – 18” oc	UPL, Introduced, ComAvail, hardy and visually attractive, Adapts to most locations away from direct salt spray (Hicks)
Commelina diffusa	Climbing dayflower, Cohítre	Forb	4” pot – fully rooted/full – 12” oc	FAC, Native, blue flower
Commelina erecta	Whitemouth dayflower, Cohítre azul	Forb	4” pot – fully rooted/full – 12” oc	FAC, Native, blue flower
Commelina rufipes	Cohítre blanco	Forb	4” pot – fully rooted/full – 12” oc	FACU, Native, white flower

Scientific Name*	**Common Names**	**Habit**	**Recommended Specification**	**Species Notes** *(wetland status, origin, other notes)*
Commelina virginica	Virginia dayflower	Forb	4" pot – fully rooted/full – 12" oc	FACU, Native, blue flower
Conocarpus erectus	Button mangrove, Mangle botón	Shrub/Tree	3 gal – 24" ht x 18" spr/shrub form/full – 24" oc (shrub masses)	FACW, Native, small tree, ComAvail, variety 'Sericeus' has silver foliage
Cordyline fruticosa	Tiplant, Bayoneta	Shrub	3 gal – 24" ht/full – 24" oc	UPL, Introduced, color/texture accent, Needs part shade and well-drained soils
Croton lobatus	Lobed croton, Croton lobulado	Shrub	3 gal – 24" ht/full – 24" oc	FACU, Native
Cymbopogon citratus	Lemon grass, Limoncillo	Gram.	1 gal – 12" ht/full – 18" oc	UPL, Introduced
Cyperus aggregatus	Inflated scale flat sedge	Gram.	3 gal – 24" ht/min 5 stems/full – 36" oc	FACU, Native
Cyperus croceus	Baldwin's flat sedge	Gram.	3 gal – 24" ht/min 5 stems/full – 36" oc	FAC, Native
Cyperus ligularis	Mangrove flat sedge, Junco de agua	Gram.	3 gal – 24" ht/min 5 stems/full – 36" oc	FAC, Native
Cyperus planifolius	Flatleaf flat sedge	Gram.	3 gal – 24" ht/min 5 stems/full – 36" oc	FACU, Native, common from coastal environs to El Yunque (Liogier)
Cyperus polystachyos	Manyspike flat sedge	Gram.	3 gal – 24" ht/min 5 stems/full – 36" oc	FACW, Native, very common in moist and grassy places at lower to middle elevations (Liogier)
Cyperus sphacelatus	Roadside flat sedge	Gram.	3 gal – 24" ht/min 5 stems/full – 36" oc	FAC, Native
Dietes irioides	African iris	Forb	1 gal –12" ht/full – 18" oc	UPL, Introduced, ComAvail, Performs well in both aquatic and terrestrial plantings (Hicks)
Dracaena reflexa	Song of India	Shrub	3 gal – 18" ht/full – 24" oc	UPL, Introduced, ComAvail, Easy to grow, full sun
Dysphania ambrosioides	Mexican tea, Apazote	Forb	1 gal – 12" ht/full – 18" oc	FAC, Native, widely distributed (Liogier)

Scientific Name*	**Common Names**	**Habit**	**Recommended Specification**	**Species Notes** *(wetland status, origin, other notes)*
Epipremnum pinnatum	Centipede tongavine, Golden pothos, Mata de agua, Trepapalo amarillo	Vine	4" pot – 3 runners/overflowing pot – 18" oc	FAC, Introduced, groundcover-climbing vine, requires full to part shade
Euphorbia cyathophora	Fire on the mountain, Maravilla	Forb	1 gal – 12" ht/full – 18" oc	FACU, Native
Euphorbia heterophylla	Mexican fireplant, Leche vana	Forb	1 gal – 12" ht/full – 18" oc	FACU, Native
Ficus citrifolia	Wild Banyantree, Shortleaf fig, Jagüeíllo	Tree	7 gal – 6' ht/full	FACU, Native, ComAvail
Ficus trigonata	Jagüey blanco	Tree	15 gal – 8' ht x 3' spr/single trunk/full	FACU, Native, ComAvail
Fimbristylis spp.	Fimbry, Junquito	Gram.	3 gal – 24" ht/min 5 stems/full – 36" oc	FACW, Native / Introduced, several species, all water-loving and generally coastal (Liogier)
Hamelia axillaris	Balsamillo	Shrub	3 gal – 24" ht/full – 24" oc	FAC, Native, attractive flowers
Hamelia patens	Scarletbush, Bálsamo	Shrub	3 gal – 24" ht/full – 24" oc	FAC, Native, attractive flowers
Hibiscus tiliaceus	Emajagua, Mahoe	Shrub/Tree	7 gal – 6' ht/full	FACW, Introduced?, attractive flowers, ComAvail, (= H. pernambucensis?)
Ipomoea pes-caprae	Bayhops, Beach morning glory, Bejuco de playa	Vine	4" pot – 4" ht/overflowing pot – 18" oc	FAC, Native, attractive flowers
Lantana camara	Hedgeflower, Cariaquillo	Shrub	1 gal – 6" ht/overflowing pot – 18" oc	FACU, Native, attractive flowers
Leonotis nepetifolia	Christmas candlestick, Botón de cadete	Forb	1 gal – 12" ht/full – 18" oc	FACU, Introduced, attractive flowers
Lobelia cliffortiana	Cardenala azul	Forb	1 gal – 12" ht/full – 18" oc	FAC, Native

Scientific Name*	**Common Names**	**Habit**	**Recommended Specification**	**Species Notes** *(wetland status, origin, other notes)*
Melochia pyramidata	Pyramidflower, Bretónica piramidal	Forb	1 gal – 12” ht/full – 18” oc	FACU, Native, attractive flowers
Mimosa pudica	Moriviví	Forb	1 gal – 6” ht/full – 18” oc	FACU, Native
Mirabilis jalapa	Marvel of Peru, Don Diego de noche	Forb	1 gal – 12” ht/full – 18” oc	FACU, Introduced, attractive flowers
Muhlenbergia capillaris	Hairawn muhly, Sweetgrass, Pink muhly grass, Yerba de pelos	Gram.	1 gal – 12” ht/full – 18” oc	OBL? (as listed, but contradicted by Liogier and by Hicks), Native, attractive pink-flowered grass, very durable once established and will thrive in a wide variety of cultural conditions (Hicks)
Myrcia citrifolia	Red rodwood, Hoja menuda	Shrub/Tree	7 gal – 6’ ht/full	FACU, Native, attractive fruits
Nephrolepis exaltata	Boston swordfern, Helecho Boston, Helecho espada	Fern	1 gal – 8” ht/full – 24” oc	FAC, Native, ComAvail, adaptable to varied conditions, several varieties available
Oxalis corniculata	Creeping yellow woodsorrel, Trebolillo	Forb	1 gal – 6” ht/full – 18” oc	FACU, Native
Paspalum paniculatum	Arrocillo	Gram.	3 gal – 24” ht/min 5 stems/full – 36" oc	FAC, Native
Philodendron giganteum	Giant philodendron, Yautía cimarrona	Vine	3 gal – 24” ht/full – 36” oc	FAC, Native
Pilea leptophylla	Puerto Rico clearweed	Forb	1 gal – 12” ht/full – 18” oc	FAC, Native (Endemic)
Pitcairnia angustifolia	Piña cortadora	Forb	1 gal – 12” ht/full – 18” oc	FAC, Native
Podocarpus coriaceus	Yucca plum pine, Caobilla	Tree	7 gal – 6’ ht/full	FAC, Native, in the conifer group
Portulaca pilosa	Kiss me quick, Don Diego	Forb	1 gal – 12” ht/full – 18” oc	FACU, Native, attractive flowers

Scientific Name*	**Common Names**	**Habit**	**Recommended Specification**	**Species Notes** *(wetland status, origin, other notes)*
Rhynchospora radicans	Tropical whitetop, Yerba de estrella	Gram.	1 gal – 12" ht/full – 18" oc	FAC, Native
Roystonea borinquena	Puerto Rico royal palm, Palma real	Palm	B&B – 2'-25' GW/single, straight trunk with no scars or bottle necking/full	FAC, Native, ComAvail, beautiful native palm that thrives almost anywhere with full sun, fast grower in wet locations
Ruellia caerulea	Britton's wild petunia, Mexican bluebell, Ruellia, A-las-doce-me-voy	Forb	1 gal – 8" ht/full – 24" oc	FACW, Introduced, attractive flowers, ComAvail, also reproduces from cuttings, cut back hard 2-3 times/year (Hicks)
Saccharum officinarum	Sugarcane, Caña de azúcar	Gram.	5 gal – 48" ht/min 3 stems/full – 36" oc	FACU, Introduced, ComAvail
Sagittaria lancifolia	Bulltongue arrowhead	Forb	1 gal – 12" ht/full – 24" oc	OBL, Native, Requires regularly inundated site
Sansevieria spp.	Snake plant, Lengua de vaca	Forb	1 gal – 12" ht/full – 24" oc	UPL, Introduced, ComAvail, Adapted to both wet and dry environs (Hicks), Aggressive roots
Schefflera morototonii	Matchwood, Yagrumo macho	Tree	7 gal – 6' ht/full	FAC, Native
Solanum americanum	American black nightshade, Yerba mora	Forb	1 gal – 12" ht/full – 24" oc	FAC, Native
Sphagneticola trilobata (Wedelia trilobata)	Creeping oxeye, Wedelia, Manzanilla	Forb	4" pot – overflowing pot/full – 12" oc	FACU, Introduced? (Caribbean Native), ComAvail, also reproduces from cuttings, Attractive yellow flowers, Dense groundcover adapted to many environs
Stachytarpheta jamaicensis	Light-blue snakeweed,	Forb	4" pot – overflowing pot/full – 12" oc	FACU, Native, attractive flowers

Scientific Name*	Common Names	Habit	Recommended Specification	Species Notes *(wetland status, origin, other notes)*
	Blueflower, Verbena			
Swietenia macrophylla	Honduras Mahogany, Caoba hondureña	Tree	15 gal – 8' ht/single trunk/full	FACU, Introduced, tree
Tabebuia rigida	Roble de sierra	Shrub/Tree	7 gal – 6' ht/full	FAC, Native (Endemic), attractive flowers, higher elevations
Tabebuia schumanniana	Roble colorado	Tree	7 gal – 6' ht/full	FACW, Native (Endemic), attractive flowers, higher elevations
Terminalia catappa	Indian almond, Almendra	Tree	15 gal – 8' ht/single trunk/full	FACU, Introduced
Thespesia populnea	Portia tree, Emajagüilla, Seaside Mahoe	Shrub/Tree	7 gal – 6' ht/full	FAC, Introduced?
Thunbergia alata	Blackeyed Susan vine, Culo de poeta	Forb	4" pot – overflowing pot/full – 12" oc	FACU, Introduced, attractive flowers
Tradescantia zanonia	Cohítre blanco	Forb	4" pot – overflowing pot/full – 12" oc	UPL, Native, moist and shaded environs
Tradescantia zebrina	Inchplant, Cohítre morado	Forb	4" pot – overflowing pot/full – 12" oc	FACU, Introduced, attractive foliage, moist and shaded environs
Wedelia fruticosa	Coastal plain creeping oxeye, Wedelia, Margarita de las rocas	Forb / Shrub	1 gal – 6" ht / overflowing pot – 18" oc	FAC, Native, yellow flower
Zingiber zerumbet	Bitter ginger, Jenjibre amargo	Forb	3 gal – 18" ht/min 5 canes/full – 24" oc	FACW, Introduced

*** NOTES**

1. Scientific Name = Current scientific name accepted by the USDA PLANTS Database, accessed at: http://plants.usda.gov/ on 20 January 2016.
2. Common Names = Common names in English and Spanish preferred by the USDA PLANTS Database (see Note 1) and Liogier and Martorell (2000).
3. Habit = The common plant form for the species: Fern, Vine, Forb, Graminoid, Shrub, Palm or Tree.
4. Recommended Specification = A suggested set of characteristics required of the plant stock acquired for installation in the landscape and the recommended planting spacing. This

specification will vary according to design intent and the available stock in the nursery trade. The Landscape Architect should modify this specification to suit the particular project site, design intent, and stock availability.

5. Species Notes = For each recommended species its Wetland Status is given first, followed by its origin (provenance) with respect to the Islands of Puerto Rico, and planting notes or any other notes of interest for the species. Wetland Status is according to the USACE Caribbean Wetland Plant List of 2014 (U.S. Army Corps of Engineers, National Wetland Plant List – Caribbean Region, version 3.2, accessed at: http://wetland_plants.usace.army.mil/ on 20 January 2016). For an explanation of Wetland Status codes see: http://plants.usda.gov/wetinfo.html. Origin (Native Status) is according to the USDA PLANTS Database (see Note 1) and cross-referenced with Liogier and Martorell (2000). "ComAvail" means commercially available at the time of writing. Planting notes are adapted from Hicks (2013), habitat descriptions found in Liogier and Martorell (2000), and personal observations by the author. See the References section and the main text that accompanies this table. Some UPL species that have been successful bioswale plants are recommended.
6. This table is Appendix A of the following document: *Terrasa-Soler, José Juan. 2016. Recommended Species for Rain Gardens, Bioswales, and Bioretention Cells in Puerto Rico and the Caribbean Islands. San Juan, Puerto Rico. Originally published at: https://jterrasa.wordpress.com/*