Tree/Shrub Establishment

Conservation Practice Standard 612, Practice Specifications

SCOPE

NRCS Tree/Shrub Establishment.

This specification serves as a guide for planning the implementation of the conservation practice **Tree/ Shrub Establishment, Code 612**. It contains a list of considerations for the planner and the NRCS requirements and limitations of this practice. It provides information and guidance for users to: select plant species, determine plant spacing, prepare furrows or holes for planting trees and/or shrubs, implement plant protection and cultural treatments to ensure adequate survival and growth of plants, and maintain plants.

Procedures, technical details, and other information listed below provide additional guidance for carrying out selected components of the **Tree/ Shrub Establishment, Code 612,** practice. This material is referenced from the conservation practice standard for the named practice and supplements the requirements and considerations listed therein.

DEFINITION

Establishing woody plants by planting seedlings or cuttings, by direct seeding, and/or through natural regeneration.

PURPOSE

This practice is applied to support one or more of the following purposes:

- Maintain or improve desirable plant diversity, productivity, and health by establishing woody plants.
- Create or improve habitat for desired wildlife species compatible with ecological characteristics of the site.
- Control erosion.
- Improve water quality. Reduce excess nutrients and other pollutants in runoff and groundwater.
- Sequester and store carbon.
- Restore or maintain native plant communities.
- Develop renewable energy systems.
- Conserve energy.
- Provide for beneficial organisms and pollinators.

CONDITIONS WHERE PRACTICE APPLIES

Tree/shrub establishment can be applied on any site capable of growing woody plants.

GENERAL

This specification provides guidance to install the practice **Tree/Shrub Establishment**. Guidance may include information not directly addressed in the standard. Site specifications for the installation, operation and maintenance of the practice shall be prepared for each field or treatment unit in accordance with the requirements in the Conservation Practice Standard (CPS) and the guidance in this Specification.

The practice addresses the concern that forest stocking levels do not meet the minimum recommended number of trees per acre. The existing condition of the forest stand does not meet the landowner's objectives. To be a viable forest, additional seedlings need to be planted. Also, when the resource concern of plant structure and composition is identified. Plants listed as noxious weeds (https://plants.usda.gov/java/noxious) by the state or territory shall not be established for this practice. In addition, species to be planted shall not host pests or diseases that could pose a risk to nearby crops.

SITE PREPARATION

Tree/Shrub Establishment (Code 612) implementation requires appropriate preparation of the site. Planting sites shall be properly prepared based on the soil type and vegetative conditions.

Container and bagged trees can have a significant portion of their root system damaged when managed at the nursery. As a result, trees commonly exhibit what is known as "transplant shock." Transplant shock is a state of slowed growth and reduced vitality following transplanting. Trees experience transplant shock particularly if they have circling or kinked roots that must be cut. Proper site preparation, careful handling to prevent further root damage, and good follow-up care reduces transplant shock and promotes faster recovery.

For site preparation, consider using CPS Tree/Shrub Site Preparation (Code 490). Tree/shrub site preparation is the treatment of areas to improve site conditions for establishing trees and/or shrubs. This practice is used to encourage natural regeneration of desirable woody plants and to permit artificial establishment of woody plants.

Methods of site preparation include hand site preparation using hand tools (e.g. trimmers, lawn mower, shovels, garden hoe, machetes, pickaxes), chemicals method, using herbicides (always follow label recommendations) and biological control (cattle, sheep and goats). Implementation of the hand site preparation method is recommended. Mulch may be used for weed control and moisture retention for new plantings on all sites, particularly those with pronounced growing season moisture deficits or invasive, weedy species. Refer to Mulching (Code 484) for installation procedures.

PLANTING IN THE RIGHT PLACE

When planting a tree/shrub, avoid overhead utility lines such as power and communication. Do not plant over or beside underground utilities such as sewer or potable water systems or pipelines. Do not plant under overhead lines (see Figure 1).

Figure 1.A Tree Planting Guide for Puerto Rico and other Caribbean Countries, USDA Forest Service.

The recommended distance for tree planting near overhead lines depends on the voltage of the electric line and the utility company's easement for the line(s). On average, for a 38 kV electric line the distance to plant a tree should be between 25 feet to 50 feet of the main conductor, depending on mature tree height and crown width as shown in the table below:

Mature Tree Height (feet)	Recommended horizontal distance from power lines (feet)
15-30	25
30-50	50
>50	>50

Planting trees, shrubs, or any other vegetation inside and outside the power line right of way (ROW) should be avoided. Distances of crown width or tree height should never reach between 12-20 feet around the structures (post, towers, guy wires, circuits), depending on the circuits.

Do not plant trees within 15-25 feet (more if the tree is a large species) from houses, buildings, or structures. In urban areas select the tree with correct root-growth pattern to avoid tree roots causing problems like cracking and heaving of curbs and sidewalks.

SPECIES SELECTION AND SPACING

Proper tree/shrub care begins with selecting the right vegetation and planting it in the right place. Make sure your tree/shrub will thrive — especially once fully grown — where you want to plant it. Things to consider includes the tree/shrub's purpose and planting site limitations.

- Are you planting it for aesthetics, privacy, shade/energy reduction, windbreak, or as a street tree/shrub?
- What is your hardiness zone?
- What is the maximum height and spread for a tree/shrub in the space?
- What are the sun exposure and soil conditions?

Your end goal will determine the suitability of chosen tree/shrub species.

Species Selection

Good tree/shrub care starts with a healthy individual.

- Tree/shrub grown in biodegradable bags:
  - Roots should be moist and fibrous.
  - Biodegradable bags are ready to be planted directly in the ground.
- Container-grown tree/shrub:
  - Containers should not have trees with large, circling roots.
  - Pruned roots should be cut cleanly. Do not prune roots wider than a finger.
  - Soil and roots should be joined tightly.

Examples of suitable species which may be used for tree/shrub establishment for each life zone in Puerto Rico and U.S. Virgin Islands are included in Appendix 1. This table is a guide and not intended to exclude other species.

Ecological Life Zones are listed for each plant to assist with the selection and design process for establishing new trees/shrub. Ecological life zones, described by Ewel & Whitmore, 1973, for Puerto Rico and the U.S. Virgin Islands, are major climatic divisions and define the conditions for ecosystem functioning. Figure 2 (below) shows the life zones and municipalities.

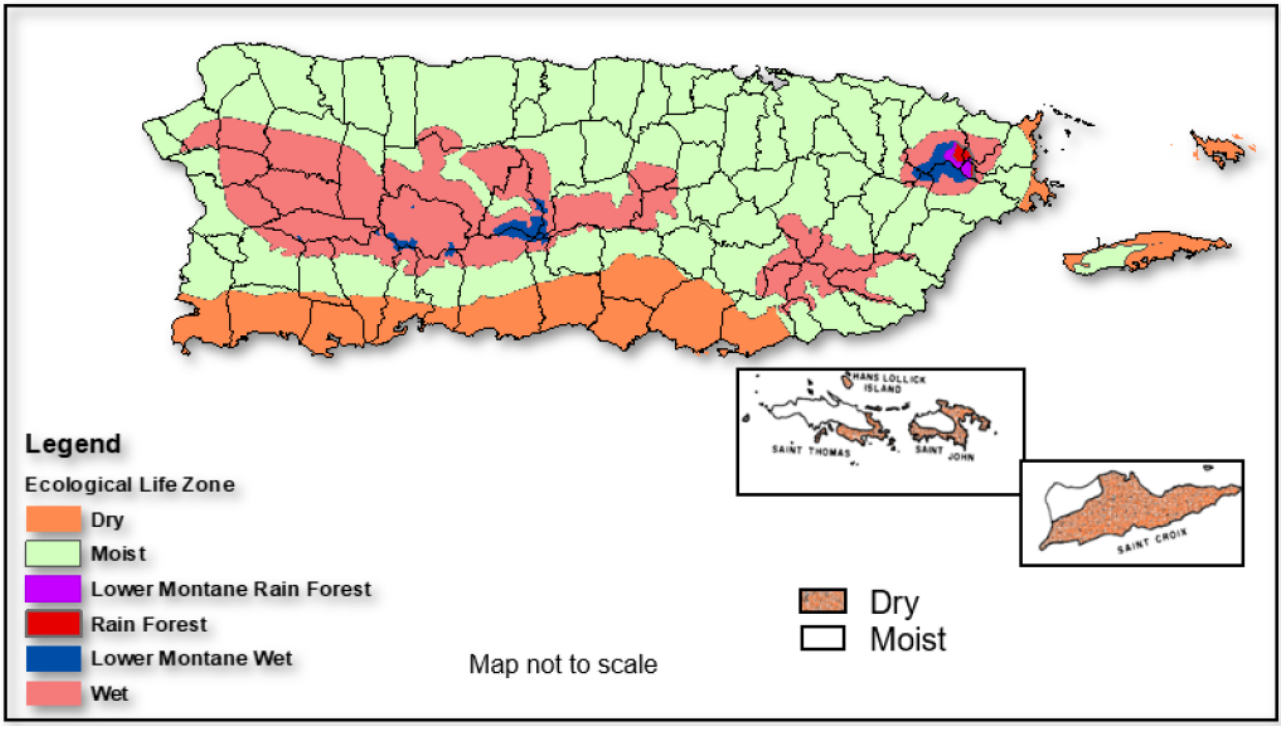

Figure 2. PR and USVI Ecological Life Zones. Source: Ecological Life Zones for Puerto Rico and the U.S. Virgin Islands, Ewel & Whitmore, 1973.

Species Spacing

Potential mature height, canopy spread, trunk flare and root space are all important factors to consider before deciding on the planting distance. Know what the tree/shrub will look like as it nears maturity. Heights may be estimated based on performance of the individual species (or comparable species) in nearby areas on similar sites. See Table 2 for density specifications.

Table 2. Planting density specifications

Plant Types/Typical Heights:	Plant-to-Plant Spacing:
Shrubs less than 10 feet	1.5 to 4 feet
Shrubs and trees from 10 to 40 feet	6 to 10 feet
Trees greater than 40 feet	10 to 18 feet

Planting Pattern

The distance between rows and tree/shrub defines the Planting Pattern: for example, square, rectangular, triangle or diamond ("*tres bolillos*") and irregular, as shown below.

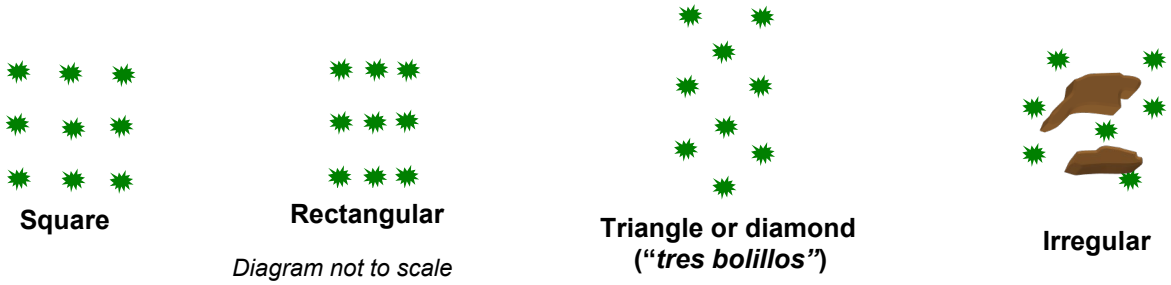

Figure 3. Planting pattern diagrams.

- **Square pattern:** distance between tree/shrub is the same between columns and rows.
- **Rectangular pattern:** tree/shrub are closer within the row than between columns.
- **Triangle or diamond (*tres bolillos*) pattern:** tree/shrub at the corner of the square and one tree in the center; all tree/shrub are the same distance from each other.
- **Random or Irregular:** when obstacles such as rocks are present or when the landform does not provide for regular arrangement.

For natural appearance, plant tree/shrub in a random or irregular pattern.

SELECTION AND CARE OF PLANTING MATERIAL

Care in handling and planting of the seeds, cuttings or seedlings will ensure that planted materials have an acceptable rate of survival.

Only viable, high-quality and adapted planting stock or seeds will be used. Do not plant tree/shrub that have scrapes on the bark.

It is recommended to plant trees and shrubs that have a height between 2-4 feet. Avoid planting material taller than the desirable size because it will decrease the survival rate.

Keep roots of planting stock moist at all times before planting. Cuttings may be rooted in pots or beds and then transplanted. Unrooted cuttings may be planted directly depending on the species, available moisture and other conditions.

Consider using a rooting hormone to enhance rooting percentage. If the roots are tangled or compacted, it is recommended to cut a portion with scissors or a sharp knife before planting.

PLANTING

Considerations to choose the right planting sites:

- Soil type (drainage, fertility, and texture),
- Periodic flooding,
- Amount of available sunlight,
- Existing plant competition, and
- Exposure/aspect/orientation of the terrain.

Selection of planting technique and timing will be appropriate for the site and soil conditions.

Planting should be done as early in the wet season as possible. Avoid planting on hot, windy days.

If individual planting holes are dug through sod or untilled ground, make them as large as practicable and clear a 3 to 4-foot diameter circle outside of the hole at the time of planting. Dig a planting hole that provides plenty of room for the roots. The hole's diameter should be two times the pot diameter and have the same depth.

Remove the tree/shrub from the container and always pick it up by the root ball, never by the trunk. Place the tree/shrub in the hole at the same depth it grew in the nursery and make sure the trunk is straight (See Figure 4). All material (root ball out of the container) should be completely buried; exposed material will act as a wick, drawing water out of the planting hole.

Refill the hole with the same soil removed from the hole. Settle the soil by watering as you refill the hole with soil to eliminate air pockets. Do not place soil on top of the root ball and tamp earth

firmly above the root zone.

Mound up soil 6 inches high, 2 feet out from the trunk to form a ring or basin to hold water. This will keep the water where it is needed instead of running off the surface.

Place a 3-inch layer of mulch around each tree/shrub to prevent water loss. Consider applying the practice Mulching (Code 484), if appropriate. Stake newly planted trees **only if needed**.

Trees usually do better if they can become established without staking, but in many cases, trees need staking to protect the trunk from equipment, to anchor the root system against the wind, or to support a limber trunk in an upright position. Place one or two 2x2 wooden stakes and keep them as short as possible, but long enough so the tree stands up right. Tie the tree at only one level. The trunk and branches should not be allowed to rub against stakes. Use an old garden hose with wire running through it, nylon bands or other nonabrasive material, and wrap loose enough to allow for trunk growth. Use stakes for the shortest possible time (usually one year).

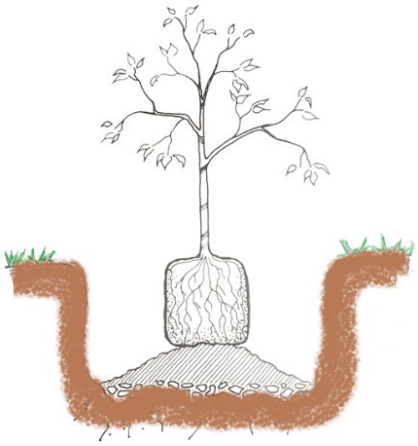

Figure 4. Image adapted from: "Árboles para uso urbano en Puerto Rico e Islas Vírgenes", USDA Forest Service. General Technical Report SO-57. December 1985. (Correct position or way to plant a tree/shrub.)

WILDLIFE CONSIDERATION

When applying this practice to create or improve habitat for desired wildlife species compatible with ecological characteristics of the site, use a combination of native trees and shrubs that provide food resources for the desired species. Select fruit species to provide food sources for targeted wildlife from table 1 in the Appendix. Consult the NRCS Caribbean Area Biologist for more information on recommended shrubs and trees for wildlife habitat improvements.

Implement this practice to create or improve habitat for desired wildlife species when the Caribbean Area Wildlife Habitat Evaluation Index (located in Section I of the Electronic Field Technical Guide (eFOTG)) identifies habitat-limiting factor(s).

OPERATION AND MAINTENANCE

Continuous maintenance of young trees, shrubs and grasses is key for vegetation survival and health. Plants will be maintained by different methods, depending on type, until maturity. Monitor vegetation establishment for at least 6 months to ensure survival.

Competing vegetation must be controlled until trees/shrubs become established. Control should continue beyond the establishment period, if necessary.

Supplemental planting may be required when survival is too low to produce a continuous tree/ shrub area.

Watering

Watering is key for plant survival. Learn your vegetations' water requirements to determine the frequency of watering. Water each tree/shrub thoroughly at planting and every two days during dry periods. Once the tree/shrub is established, watering the vegetation every week will be enough. Remember, water thoroughly and more frequently during warm days and drought season. Water deeply to promote healthy root development. Keep watering during the next 6 months after planting, if necessary.

Fertilizing and treatment of pests and diseases

Fertilizing is the answer to nutrient deficiencies. Fertilizer application is based on a soil test and the practice Nutrient Management (Code 590). If you notice that your tree/shrub's leaves are yellow, its development is slow, or a pest or disease is affecting the tree, consult Puerto Rico Department of Natural and Environmental Resources, US Virgin Islands Department of Planning and Natural Resources, an Extension Service Specialist or your local NRCS field office.

FREQUENTLY ASKED QUESTIONS

1. What to do if tree/shrub height is more than the recommended 2-4 feet?

   - When planted, the tree should be reinforced with a wooden stake and loosely attached to keep it standing upright. This will help maintain that position until it is strong enough and established (see the bottom of page 6).

2. What to do if roots are exposed outside of the container?

   - Carefully remove the tree/shrub from the container without damaging the root system. Prune exposed, damaged, and strangled roots if necessary, especially the ones growing from the main root. This will promote new vertical root growth when planted.

3. Where to store the young trees and shrubs once delivered, if they will not be planted upon delivery?

   - They must be stored in a shaded and ventilated area elevated from the ground to prevent direct contact with the soil. This will prevent exposed tree and shrub roots from getting attached to the ground. Water must be provided as needed to keep them moist.

4. Should a polymer be added to the trees/shrubs when planted?

   - Polymers are normally recommended for areas where drought is frequent or for dry areas with poor water retention and availability. If the area to be planted has these conditions, polymers are recommended.

5. Can I choose another tree/shrub species not mentioned in table1 of this document?

   - Yes, as long as the species is not invasive, is native, and approved by the NRCS Agroforester and Grassland Specialist or the Caribbean Area Biologist. Availability of the species will be a limiting factor as well.

6. What is the minimum distance between tree/shrub in this conservation practice?

   - Minimum distance between trees in this practice is 15 to 20 feet. The preferred planting pattern is "Tres bolillos," but depends on the landowner's objectives.

7. Do I need to protect the planting tree/shrub from livestock and wildlife? How I can protect them?

   - Yes, protection must be installed (such as Livestock Exclusion Fencing, Code 382) to protect trees from livestock and wildlife.

8. What other practices are recommended to plan with **Tree/Shrub Establishment**?

Associated Practices

Some conservation practices may be applied alone and others in combination with other supporting Caribbean Area conservation practices.

The following practice is required where livestock are present:

- Fence (382)

The following practices are recommended but not limited to:

- Tree/Shrub Site Preparation (490)

- Tree/Shrub Pruning (660)
- Upland Wildlife Habitat Management (645) or Wetland Wildlife Habitat Management (646)
- Structure for Wildlife (649)
- Mulching (484)

REFERENCES

1. A Tree Planting Guide for Puerto Rico and other Caribbean Countries, USDA Forest Service, October 1995.
2. Árboles Comunes de Puerto Rico y las Islas Vírgenes.
3. Arbor Day Foundation, *Tree Care Tips & Techniques* - http://www.arborday.org.
4. Backyard Conservation, Tree Planting USDA NRCS, National Association of Conservation Districts, Wildlife Habitat Council, August 1998.
5. Ecological Life Zones, for Puerto Rico and the US Virgin Islands Ewel & Whitmore, 1973.
6. Fish and Wildlife Service, Wildlife Tree and Shrub Plant List (unpublished).
7. Guía de reforestación para las Cuencas Hidrográficas de Puerto Rico, Departamento de Recursos Naturales y Ambientales, 1998.
8. Planning for Tree Planting, Landowner Resource Centre and the Ontario Ministry of Natural Resources. http://www.seedlingnursery.com/downloads/PLNGTRPL.PDF.
9. Plantation Forestry in the Tropics, by Julian Evans; Planting Patterns, Dave Wilson Nursery.
10. Siembra Hoy, Pensando en el Mañana, Autoridad de Energía Eléctrica.
11. Something to grow on; http://www.ag.auburn.edu.
12. South Carolina Urban Tree Species Guide; Choosing the Right Tree for Right Place http://www.state.sc.us/forest/urbsg04.htm.

Appendix 1. Recommended tree species for **Tree/Shrub Establishment** for each Ecological Life Zone in the Caribbean Area.

			Subtropical Lower Montane Wet Forest	Subtropical Wet Forest		Subtropical Moist Forest				Subtropical Dry Forest	
Scientific	**Español**	**English**	**Volcanic**	**Moist Serpentine**	**Volcanic**	**Sedimentary Moist Volcanic**	**Limestone**	**Moist Alluvial**	**Ultramaphic**	**Dry Alluvial**	**Volcanic limestone**
Alchornea latifolia	Achiotillo	Dove-wood	x	x	x	x	x				
Alchorneopsis floribunda	Palo de gallina										
Anadenanthera peregrina	Cojóbana										
Andira inermis	Moca	Cabbage angelin		x	x	x	x	x	x	x	x
Ardisia obovata	Mameyuelo										
Avicennia germinans	Mangle negro	Black mangrove									
Bourreria succulenta	Palo de Vaca	Pigeon berry		x			x	x	x	x	x
Buchenavia tetraphylla	Granadillo	Yellow olivier			x		x				
Bucida buceras	Ucar	Black olive		x		x	x	x	x	x	x
Busera simaruba	Almacigo	Turpentine tree		x		x	x	x	x	x	x
Byrsonima spicata	Maricao	Hogberry	x	x	x	x	x		x		
Calophyllum antillanum	Maria	Santa María		x	x	x	x	x			
Casearia arborea	Rabo de Raton	Casearia		x		x	x	x			
Casearia decandra	Tostado	Wild honey tree		x		x	x	x			
Casearia guianensis	Palo Blanco	Wild coffee		x	x	x	x				x
Casearia sylvestris	Cafeillo	Wild coffee		x	x	x	x	x	x	x	x
Cedrela odorata	Cedro Hembra	Spanish cedar	x	x	x	x	x	x	x	x	x

Ceiba pentandra	Ceiba	Silk cotton tree		x		x	x	x	x	x	x
Chrysobalanus icaco	Icaco	Icaco					x	x	x	x	x
Citharexylum caudatum	Pendula de Sierra	Fiddlewood	x		x	x					
Citharexylum fruticosum	Pendula	Pasture fiddlewood					x	x	x	x	x
Clusia rosea	Cupey	Wild mammee	x	x	x	x	x	x	x	x	x
Coccoloba diversifolia	Uvilla	Dove plum					x	x	x	x	x
Coccoloba pubescens	Moralon	Leather coat tree		x			x	x		x	
Coccoloba uvifera	Uva de playa										
Cojoba arborea	Cojoba										
Colubrina arborescens	Abeyuelo										
Conocarpus erectus	Palo colorado										
Cordia alliodora	Capa Prieto	Onion cordia	x	x	x	x	x	x	x	x	x
Cordia collococca	Cerezo	Clammy cherry					x		x	x	x
Cordia sulcata	Moral	White manjack	x	x	x	x	x	x			
Cupania americana	Guara	Candlewood tree		x	x	x	x	x			
Dendropanax arboreus	Pollo	Galipee	x	x	x	x	x	x			
Elaeodendron xylocarpum	Grajo										
Erythroxylum areolatum	Indio	Ridge redwood		x			x	x	x	x	x
Eugenia monticola	Birigi, Hoja menuda	Coscorrón									
Eugenia rhombea	Guayabilla de costa	Spiceberry eugenia					x	x	x	x	x
Exostema caribaeum	Albarillo	Caribbean princewood		x			x	x	x	x	x
Faramea occidentalis	Café Cimarron	False coffee	x	x	x	x	x	x			x

Ficus citrifolia	Jaguey Blanco	Shortleaf fig		x	x	x	x	x	x	x	x
Genipa americana	Jagua	Genip, Kenip		x	x	x	x	x			
Guaiacum officinale	Guayacán										
Guapira fragrans	Corcho	Black mampoo		x			x	x		x	x
Guarea guidonia	Guaraguao	American muskwood		x		x	x	x			
Guarea glabra	Guaraguaillo		x		x	x	x				
Guazuma ulmifolia	Guacima	Jacocalalu		x	x	x	x	x	x	x	x
Hyeronima clusioides	Cedro macho	Cedro macho	x	x	x	x	x	x			
Inga laurina	Guama	Sweet pea	x	x	x	x	x	x		x	
Inga vera	Guaba	White sweet pea	x	x	x	x	x	x			
Laguncularia racemosa	Mangle blanco	White mangrove									
Magnolia portoricensis	Jaguilla	Puerto Rican Magnolia	x		x						
Manilkara bidentata	Ausubo	Balata	x	x	x	x	x	x			
Miconia impetiolaris	Camasey de costilla										
Miconia prasina*	Camasey blanco	Sardine	x	x	x	x	X	X			
Miconia racemosa	Camasey de felpa										
Thespesia grandiflora	Maga	Purple Haiti haiti		X		X	X	X			
Myrcia deflexa	Cieneguillo	Goyavier	x	x	x	x	x	x			
Myrcia splendens	Hoja menuda	Birchberry	x	x	x	x	x				
Nectandra coriacea	Laurel avispillo	Jamaica nectandra		x		x	x	x		x	x
Ocotea floribunda	Laurel Espada	Black sweet wood	x		x		x	x			
Ocotea leucoxylon	Laurel Geo	Loblolly sweet wood	x	x	x	x	x	x			

Ormosia krugii	Palo de matos										
Ouratea littoralis	Abey amarillo										
Petitia domingensis	Capá blanco										
Phlebotaenia cowellii	Árbol de violeta										
Pictetia aculeata	Tachuelo										
Pimenta racemosa	Malagueta										
Pisonia albida	Corcho bobo										
Plumeria alba	Alelí										
Podocarpus coriaceus	Caobilla										
Poitea florida	Retama San José										
Prestoea acuminata	Palma de sierra										
Pterocarpus officinalis	Palo de pollo										
Randia aculeata	Tintillo										
Rauvolfia nitida	Cachimbo										
Rhizophora mangle	Mangle rojo										
Roystonea borinquena	Palma real										
Sabal causiarum	Palma de sombrero										
Samyda dodecandra	Guayabilla										
Schaefferia frutescens	Cafeíllo, Jiba										
Sideroxylon foetidissimum	Tortugo amarillo										
Sideroxylon salicifolium	Sanguinaria										
Spondias mombin	Jobo, Jobillo										

Tabebuia haemantha	Roble cimarrón										
Tabebuia heterophylla	Roble blanco, Roble nativo										
Thouinia portoricensis	Serrasuela									x	x
Thrinax morrisii	Palma de escoba										
Trichilia pallida	Gaeta	Marie-jeanne	x	x	x	x	x	x	x	x	x
Zanthoxylum flavum	Aceitillo	Yellow sanders	x	x	x	x	x	x	x	x	x
Zanthoxylum martinicense	Espino Rubial	White prickle	x	x	x	x	x	x			
Zanthoxylum monophyllum	Palo Rubio	Yellow prickle		x			x	x	x	x	x

Additional information related to recommended species provided above:

Species availability for Caribbean Area will be subject to commercial and private nurseries stock inventory. Please check with nurseries before making a recommendation for a specific species.

The recommended trees and shrubs provided in the lists above are not exclusive. Other native trees and shrubs could be considered. Consult with NRCS for further guidance.

Some species from the above table ("*Recommended tree species for Tree/Shrub Establishment for each Ecological Life Zone in the Caribbean Area*") do not show the Ecological Life Zone due to the lack of information at the moment of developing this document. Consult with NRCS for further guidance if needed.

The number of native shrubs species recommended in this document is low because the Agency and partners are working on a comprehensive list of native shrubs to be recommended by conservation practices. An updated version of the table provided above will be available when the comprehensive list of native shrubs is finished.

Species not native to the USVI. Species with (*) are not recommended to plant in USVI.