



Practice Specification
Multi-Story Cropping (Code 379) and
Tree/Shrub Establishment (Code 612)
Mixed Agroforest

General

Mixed Agroforests are closed-canopy forests with high species diversity and complex canopy structure and arrangement. The following principles are assumed with intent relating to NRCS planning & assistance:

- The principal purpose of Mixed Agroforests is to provide common forest ecosystem services by addressing resource concerns for inadequate forest structure or composition, excessive plant pest pressure, sheet & rill erosion, improving water quality (sediments, nutrients), and increasing carbon sequestration.
- Agroforests supported by NRCS will not be designed for the purpose of commercial production. Non-timber forest products (NTFP) obtained from Mixed Agroforests represent secondary benefits for subsistence needs of NRCS Cooperators.

This specification can be applied under Conservation Practice Standard (CPS) 612 Tree/Shrub Establishment or CPS 379 Multi-Story Cropping. For establishment of agroforest on a site where there will be very few or no plants after site preparation, use CPS 612 Tree/Shrub Establishment. For establishment of new canopy strata or addition of trees or shrubs in a pre-existing crop or forest system, use CPS 379 Multi-Story Cropping.

Specifications for Land Eligibility, Layout and Structure, and Species Selections

Mixed Agroforest establishment or enhancement planned under Pacific Islands Area (PIA) Conservation Practice Standards Tree/Shrub Establishment (612) or Multi Story Cropping (379) is subject to the following requirements:

1. Technical requirements relating to **land eligibility**:
 - a. Planned Mixed Agroforests shall be designated as Forest land use.
 - b. The Wildlife land use modifier can be designated only if the post-implementation native plant count exceeds 80% for tall stature trees and 80% for short-stature trees and shrubs.
 - c. Crop, Pasture, Range, Associated Agricultural Lands or weedy fallow lands can be converted to Mixed Agroforests.
 - d. Existing forests containing at least 20% native trees/shrubs by density (i.e. stems/acre) for all woody plants > 4.5 feet tall shall not be converted to Mixed Agroforests.
 - e. Existing forests with less than 20% native trees/shrubs by density for all woody plants > 4.5 feet tall may be converted to Mixed Agroforests, but all native plants must be retained as part of the planned agroforest during site preparation work.
2. Specifications relating to Mixed Agroforest **layout and structure**:
 - a. Mixed agroforests must contain a minimum of eight separate tree/shrub genera in total, with at least four separate genera in the overstory (emergent and/or high) canopy strata and four separate genera in the understory (medium and/or low) strata (Figure 1, Table 1).
 - b. No single species will comprise less than 5% of the total plants within the overstory (i.e. emergent plus high) or understory (i.e. medium plus low) strata unless there is an approved variance from the PIA State Forester.
 - c. For each species that produces NTFP: Planting in pure or homogeneous clumps or rows is

limited to five (5) plants for overstory (emergent and/or high strata) trees and 20 plants for understory (medium and/or low strata) trees and shrubs to ensure highly mixed planting arrangements.

- d. Post-implementation tree/shrub counts (pre-existing + planted) must be no less than 150 plants per acre (Table 1):
 - i. At least 25 plants per acre must be emergent and/or high canopy strata trees (25-50 is typical).
 - ii. Medium or low strata trees or shrubs that make up the difference can include high percentages of species established via cuttings and coppice-managed as sources of mulch for weed control and nutrient cycling, fodder or nitrogen fixation (suggestions in Table 2).
3. Specifications relating to Mixed Agroforest **species selections**:
- a. Native trees/shrubs will comprise at least 20% of the post-implementation tree/shrub plant count, including pre-existing plants. Such plants can provide NTFP but would not be counted under item 3.b below.
 - b. Non-native species that produce NTFP shall not exceed 50% of the post-implementation tree/shrub plant count, including pre-existing plants.
 - c. After meeting the requirements of items 3.a and 3.b above, other non-native trees/shrubs (including timber-producing trees) can be included as the remaining balance of the planting plan.
 - d. Tree/shrub species selected for Mixed Agroforests must have lifespans of at least 15 years. Any pruning or harvesting of NTFP will not destroy these plants during the 15- year practice lifespan.

Sources for screening and selecting appropriate species according to site-specific parameters such as annual rainfall and elevation include the PIA Vegetative Specification & IR Templates (go to [NRCS FOTG](#) then follow: Hawaii/Pacific Islands Area > Section IV > Ecological Sciences Tools) or the online [AgroforestryX platform](#) (© 2019 Permanent Agriculture Resources). A variance for species not included in the PIA Vegetative Specification or AgroforestryX can be submitted for review by the PIA State Forester.

Ground Covers, Erosion Control, and Short-Term Species

Site preparation activities often create large openings or leave field soils exposed. Strongly consider including CPS Conservation Cover (327), Critical Area Planting (342) or Cover Crop (340) in the plan or encouraging Clients to plant understory and groundcover species on their own to:

- Stabilize soils
- Provide green mulch
- Provide weed control via competition
- Provide nitrogen-fixation inputs (legumes)
- Utilize available sunlight at ground level during early years of tree/shrub establishment

Strongly encourage NRCS Cooperators to conduct supplemental planting beyond the required agroforest trees and shrubs detailed in item 2.d above, particularly in early years of establishment before significant overstory canopy development. Plants such as papaya, pineapple, taro, sugar cane, cassava, turmeric, chili pepper, sweet potato, vegetable crops, herbs, spices and many others may be compatible species to inter-crop and temporarily fill “canopy gaps” between young trees and shrubs.

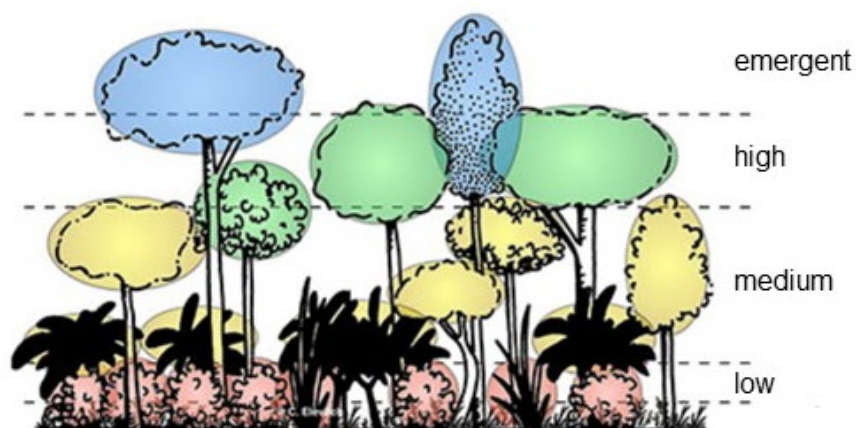


Figure 1) Diagram of relative canopy positions in a typical mixed agroforest. Color coordinated with Table 1. Used with permission from AgroforestryX.com (© 2019 Permanent Agriculture Resources).

Table 1) Canopy strata or height classes grouped by overstory and understory canopy zones. Height ranges in feet and typical light levels are shown for each canopy stratum and required minimum genera and stem density for each canopy zone. Color coordinated with Figure 1.

Canopy Zone	Stratum (height class)	Color	Light requirements	Height range	Min Genera	Min Density (stems/acre)
Overstory	Emergent	Blue	Full sun	40+ ft	4	25
	High	Green	≈80% sunlight	≈18-40 ft		
Understory	Medium	Yellow	≈60% sunlight	≈10-20 ft	4	125
	Low	Red	≈40% sunlight	≈2-12 ft		
Across all					8	150

Table 2) Species suggested for early agroforest growth phase that can be propagated by stem cuttings.

Scientific name	Common name(s)	Nitrogen fixing?	Fodder potential?	Tolerance to coppice management?
<i>Gliricidia sepium</i>	madre de cacao	Yes	Very good	High
<i>Inga edulis</i>	ice cream bean	Yes	Fair	ok if cut > 30" above grade
<i>Moringa oleifera</i>	malunggai, kalamunggai	No	Very good	High
<i>Sesbania grandiflora</i>	corkwood	Yes	Very good	Cut top only occasionally