Pacific Islands Area Vegetative Guide

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Pacific Islands Area

April 2010

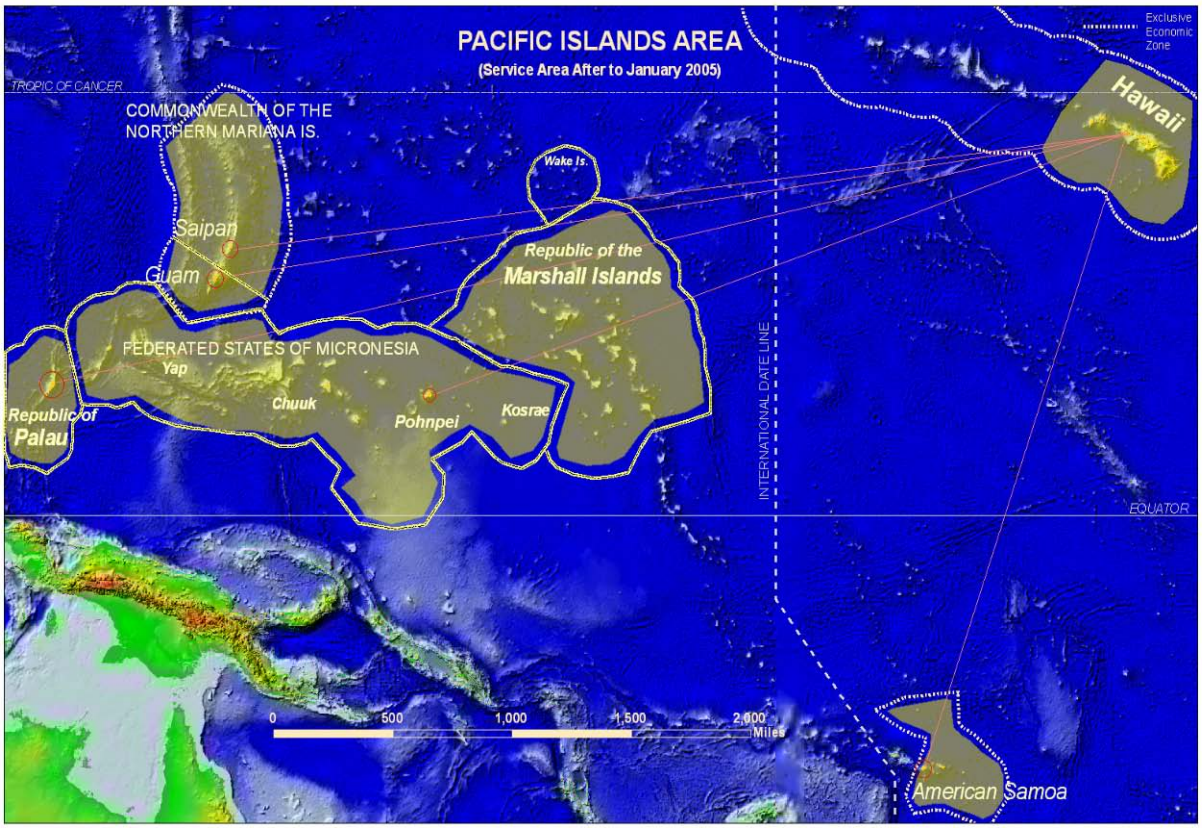

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Table of Contents

Introduction

The Pacific Islands Area (PIA) Vegetative Guide is a revision of the Pacific Islands Vegetative Guide and contains plant species information which corresponds to the information in the Conservation Practice Standards and Specifications in Section IV of the PIA Field Office Technical Guide (FOTG). The Vegetative Guide was developed to serve as a ready reference for plants suitable for the various conservation practices in Section IV. Pictures of most of the species in the tables have been included to aid in plant selection and identification.

In March 2008, generic plant establishment procedures including site preparation and planting for commonly used planting methods was added to the PIA Vegetative Guide. Refer to the Conservation Practice tables in the Vegetative Guide for planting rate and spacing recommendations. Planners should also refer to individual conservation practice Standards for practice specific and/or additional criteria for plant establishment.

The species tables include the most recent information available. Since the nomenclature of many tropical plant groups is under constant taxonomic study, every effort was made to obtain the most current plant name information. As a result, there are a number of changes in scientific names. The primary taxonomic authorities used were the USDA, NRCS.2007. The PLANTS database (http://plants.usda.gov); USDA, ARS National Genetic Resources Program. *Germplasm Resources Network – (GRIN)* (http://www.ars-grin.gov/); and the *Manual of the Flowering Plants of Hawaii* by Wagner, Herbst, and Sohmer, 1990 (Bishop Museum Press).

More species were added that are adapted to the PIA-West Area (Territory of Guam, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Republic of Palau, and Republic of the Marshall Islands) and to American Samoa. Trees in the genus *Erythrina* have been deleted from the tables because of the damage they've sustained from the erythrina gall wasp. Always keep diversity in mind when planning a windbreak or other practice to guard against the complete loss of effectiveness due to a disease or insect attack.

It is recommended that native species be selected, when possible. They are indicated in the footnotes. Seed availability of natives is an ongoing problem. Some nurseries are producing a variety of containerized native plants. Native species are included in the tables when their range of adaptation, conservation use, performance, and cultural requirements are known.

Exercise good judgment when choosing introduced species. Always consider the proximity of native forests and other native areas when using non-native species. Consider the potential for introduced species to spread. When available, sterile cultivars are recommended and are listed in the tables.

The April 2010 revision of the the PIA Vegetative Guide includes the following changes of significance:

The species tables for each conservation practice are not all-inclusive. In order to include other species not listed in each table in a client's conservation plan, planners are required to obtain the appropriate PIA State-level specialist's approval via email with concurrence from PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

To be consistent with Executive Order 13112 and NRCS policy (General Manual Title 190, Part 414), a review of the conservation practice species tables was conducted to identify and remove any species listed on either the Federal Noxious

Weed List or the State of Hawaii Noxious Weed List. This required the removal of only one species, kikuyugrass (*Pennisetum clandestinum*), 'AZ 1' and 'Whittet' cultivars from the suitable species tables for the following practices: Conservation Cover (327), Critical Area Planting (342), Grassed Waterway (412), Pasture and Hay Planting (512), Range Planting (550), and Recreation Area Improvement (562).

In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State-level specialist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan. The source of the potentially invasive species is the Hawaii-Pacific Weed Risk Assessment (HP-WRA) and the Pacific Island Ecosystems at Risk project (PIER). The information may be found online at: http://www.botany.hawaii.edu/faculty/daehler/WRA and http://www.hear.org/pier/.

The footnote for ironwood, toa, gagu, *(Casuarina equisetifolia)* was revised in the tables for the practices Critical Area Planting (342) and Windbreak/Shelterbelt Establishment (380). In the PIA West Area, this species is approved for planting because it is native. In American Samoa, this species is considered to be potentially invasive, thus planners are required to obtain the appropriate PIA State–level specialist's approval via email with concurrence from the PIA Plant Materials Specialist in order to include it in a client's conservation plan. Planners are also required to document the approval/concurrence in the client's conservation plan. In the State of Hawaii, this species is not approved for planting because it is considered to be invasive.

All the non-native species were removed from Table K. Upland Wildlife Habitat Management (645) and Table M. Wetland Wildlife Habitat Management (644).

The Plant Establishment Procedures were revised to include updated plant materials, site preparation, and planting methods information.

Seeding rates are presented as pounds of pure live seed (PLS). This means that the actual bulk field seeding rates will usually be higher than the recommended rates in the tables because the field seeding rates depend on the quality of the purchased seed. Calculate the percent PLS of the seed by multiplying the percent germination by the percent purity. Percent germination and purity of the seed should be listed on the seed container. The actual field seeding rate is calculated by dividing the recommended seeding rate by the percent PLS of the seed. Refer to Vegetative Technical Note No. 3 – Pure Live Seed Worksheet.

All legumes should be inoculated with the proper bacteria before planting. Use only fresh, age-dated inoculants specifically labeled for the legume to be seeded.

If you have questions about the Guide, please contact Bob Joy, Plant Materials Specialist, via phone at: (808) 567-6868 extension 109 or via email at: Robert.J.Joy@hi.usda.gov.

If you have questions about individual conservation practice species information, please contact the appropriate NRCS PIA State level specialist.

Table A. Conservation Cover (327)

Suitable Species (Page 1 of 1)

Grasses Normally Seeded	Rainfal (inches)	Elevation (feet)	Recommended Seeding Rate (lbs. PLS/ac)
annual ryegrass [1/] [6/] (*Lolium multiflorum*)	40 -150	0 – 7,000	
mixed w/ other grasses			10
annual ryegrass alone			20
Bermudagrass [4/] [5/] (*Cynodon dactylon*)	20 – 100 (-170)	0 – 3,000	6
'emoloa, kawelu [3/] (*Eragrostis variabilis*)	20 - 80	0 – 3,500	6
green panicgrass [4/] [6/] (*Urochloa maxima*)	25 - 70	0 – 2,500	6
'Petrie'			
narrowleaf carpetgrass [6/] [8/] (*Axonopus fissifolius*)	40 – 80 (-160)	0 – 5,000	40
oats [1/] (*Avena sativa*) Mixed w/ other grasses oats alone	40 - 150	0 – 7,000	 35 70
orchardgrass (*Dactylis glomerata*)	40 - 100	3,000 – 7,000	12
perennial ryegrass (*Lolium perenne*)	40 - 100	1,500 – 7,000	24
'Tetraploid'			
piligrass, tanglehead [3/] [7/] (*Heteropogon contortus*)	15 – 45 (-90)	0 – 2,000	6
Rhodesgrass [5/] (*Chloris gayana)* 'Bell', 'Katambora', 'Nemkat' [4/]	25 - 45	0 – 3,000	6
signalgrass [5/] (*Urochloa brizantha*)	50 - 120	0 – 3,000	9
Grasses Normally Established Vegetatively	**Rainfall** (inches)	**Elevation** (feet)	**Recommended Planting Rate** (bushels/ac [2/] disked in material)
Baron's grass, paddlegrass, reh padil [6/] [7/] [8/] [9/] (*Ischaemum polystachyum*)	50 - 200	0 – 3,000	40
broadleaf carpetgrass [8/] [6/] (*Axonopus compressus*)	40 – 160 (-200)	0 - 5000	40
digitgrass [4/] [8/] (*Digitaria eriantha*)	50 -160	0 – 3,500	40
'Mealani'			
'Pangola'			
paspalum (*paspalum hieronymii*)	50 - 150	0 – 3,000	40
'Tropic Lalo'			
St. Augustinegrass [6/] (*Stenotaphrum secundatum*)	40 - 80	0 – 3,000	40
zoysiagrass (*Zoysia japonica*) 'El Toro'	40 -100	0 – 4,000	40

Legumes	**Rainfall** (inches)	**Elevation** (feet)	**Recommended Seeding Rate**
big trefoil (*Lotus pedunculatus*) 'Grasslands Maku'	50 -100	1,500 – 6,000	10
forage peanut (*Arachis pintoi*)	50 +	0 – 3,000	20
'Amarillo', 'Forrajero'			
hetero [8/] (*Desmodium heterophyllum*)	60 - 160	0 – 2,500	10
intortum, desmodium (*Desmodium intortum*) 'Greenleaf', 'Kuiaha'	60 - 120	0 – 3,000	10
Spanish clover, kaimi clover, lattil pako [6/] [8/] (Desmodium incanum)	(40-) 60 - 120	0 -3,000	10
three–flowered beggarweed [8/] (Desmodium triflorum)	60 - 160	0 – 2,500	10
white clover (*Trifolium repens*) 'Haifa', 'Grasslands Huia'(NZ), common	35 - 80	1,500 – 7,000	10

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

[1/] Use annuals for rapid, temporary cover.
[2/] A bushel equals 1.25 cubic feet.
[3/] Native to Hawaii.
[4/] Resistant to root-knot nematodes.
[5/] Tolerant of soil salinity and wind-borne salt
[6/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan.
[7/] Native to PIA West Area.
[8/] Tolerates acid, low fertility soils.
[9/] Tolerates wet soil conditions.

Table B. Cover Crop (340)
Suitable Species (Page 1 of 4)

Species & Cultivars	**Min. Broadcast Seeding Rates** (Lbs.PLS/Ac.)	**PH Range**	**Inoculant Group**	**Approx. Growing Time in Days**	**Approx. Dry Matter Yield** (T/Ac.)	**Approx. N Content** (lbs/T Dry Matter)	**Lbs. Of Actual N/T Dry Matter to Add at Plow Down**	**Optimum Planting Period & Elevation Range** (ft.)
Legumes								
alfalfa (*Medicago sativa*) cv. CUF-101 Moapa 69 [1/] WL-605 WL-656 WL-711 WF [1/] [8/]	20	6.0 – 8.0	Alfalfa	90	1.5	85	0	Year round 0 – 4,000’
clover, sweet [5/] (*Melilotus alba, M. officinalis*) cv. Hubam	20	6.0 – 8.0	Clover	90	2.5	63	0	Year round 0 – 3,000’
cowpea (*Vigna unguiculata*) cv. Iron Clay [1/] , Mississippi Pinkeye Purple Hull [1/]	60	5.5 – 8.3	Cowpea	90	2	59	0	Year round 0 – 1,000’ spring/summer 0 – 2,500’
lablab, dolichos [4/] (*lablab purpureus*) cv. Rongai	60	4.5 – 6.5	Lablab specific	60	2.5	50	0	Year round 0 – 4,000’
mung bean (*Vigna radiata*)	80	5.4 – 8.3	Cowpea	60	1.5	60	0	Year round 0 – 1,000’ spring/summer 0 – 2,500’
pigeonpea [1/] (*Cajanus cajan*)	40 – 60 [3/]	5.0 – 8.3	Cowpea	90	2.5	50	0	Year round 0 – 3,000’
soybean (*Glycine max*)	75	5.5 – 8.3	Soybean	90	1.5	65	0	Year Round 0 – 2,500’

Table B. Cover Crop (340)
Suitable Species (Page 2 of 4)

Species & Cultivars	**Min. Broadcast Seeding Rates** (Lbs. PLS/Ac.)	**PH Range**	**Inoculant Group**	**Approx. Growing Time in Days**	**Approx. Dry Matter Yield** (T/Ac.)	**Approx. N Content** (lbs/T Dry Matter)	**Lbs. Of Actual N/T Dry Matter to Add at Plow Down**	**Optimum Planting Period & Elevation Range** (ft.)
sunn hemp [1/] (*Crotalaria juncea*) cv. Tropic Sun	40 – 60 [3/]	5.0 – 7.0	Cowpea	60	2.5	65	0	Year Round 0 – 1,000' spring/summer 0 – 2,500'
vetch, common [4/] (*Vicia sativa*)	60	4.5 – 6.5	Pea/vetch	90	1.5	60	0	Year round 1,500' – 4,000'
vetch, purple [4/] (*Vicia benghalensis*)	50	4.5 – 6.5	Pea/vetch	90	1.5	73	0	Year round 1,500' – 4,000'
vetch, woolypod [4/] [5/] (*Vicia villosa* ssp. *varia*) cv. Lana Namoi	40 – 60 [3/]	4.5 – 7.0	Pea/vetch	90	1.5	73	0	Year round 1,500' – 4,000' fall/winter 0 – 4,000'
Non-Legumes								
annual ryegrass [5/] (*Lolium multiflorum*) [7/]	40	5.5 – 7.0		90	1	13	25	Year round 0 – 7,000'
barley [5/] [6/] (*Hordeum vulgare)*	70	5.0 – 8.3		90	1	18	20	Year round 0 – 4,000'
buckwheat [4/] [5/] (*Fagopyrum esculentum*) cv. Japanese, common	60	4.5 – 6.5		30	1.5	18	20	Year round 0 – 4,000'
millet, pearlmillet (*Pennisetum glaucum*)	50	5.5 – 8.3		60	2	19	20	Year round 0 – 1,000' spring/summer 0 – 2,500'

Table B. Cover Crop (340)
Suitable Species (Page 3 of 4)

Species & Cultivars	Min. Broadcast Seeding Rates (Lbs. PLS/Ac.)	PH Range	Inoculant Group	Approx. Growing Time in Days	Approx. Dry Matter Yield (T/Ac.)	Approx. N Content (lbs/T Dry Matter)	Lbs. Of Actual N/T Dry Matter to Add at Plow Down	Optimum Planting Period & Elevation Range (ft.)
oats, black (*Avena strigosa*) cv. Soilsaver [1/] [5/]	70	5.5 – 7.0		60	1.5	16	20	Year round 0 – 7,000'
oats, common [5/] (*Avena sativa*) cv. Coker 234 [2/], Walken [9/] Steele, Swan, TAM 397	70	5.5 – 7.0		60	1.5	16	20	Year round 0 – 7,000'
oats, red (*Avena bysantina*)	70	5.5 – 7.0		60	1.5	16	20	Year round 0 – 7,000'
rye, cereal [5/] [6/] (*Secale cereale*) cv. Danko, Elbon	70	5.5 – 7.0		90	1.5	18	20	Year round 0 – 7,000'
sorghum x sudangrass (*Sorghum* hybrids) [1/] [5/] sorghum, forage (*Sorghum bicolor*)	50	5.5 – 8.3		60	3	13	25	Year round 0 – 1,000' spring/summer 0 – 2,500'
sudangrass (*Sorghum bicolor* ssp. d*rummondii*) [1/]	50	5.5 – 8.3		60	3	13	25	Year round 0 – 1,000' spring/summer 0 - 2,500'

Table B. Cover Crop (340)
Suitable Species (Page 4 of 4)

Species & Cultivars	**Min. Broadcast Seeding Rates** (Lbs. PLS/Ac.)	**PH Range**	**Inoculant Group**	**Approx. Growing Time in Days**	**Approx. Dry Matter Yield** (T/Ac.)	**Approx. N Content** (lbs/T Dry Matter)	**Lbs. Of Actual N/T Dry Matter to Add at Plow Down**	**Optimum Planting Period & Elevation Range** (ft.)
wheat [6/] (*Triticum aestivum*)	70	5.5 – 8.3		90	1.5	16	20	Year round 0 – 4,000'

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

[1/] Resistant to root-knot nematodes.

[2/] Rust resistant.

[3/] Increase seeding rate to 60 lbs/A if incorporating early, to produce finer stemmed material that is easier to till into the soil, or if severe weed competition is expected.

[4/] Tolerates acid/low fertility soils.

[5/] Suppresses weeds (allelopathic).

[6/] Tolerant of soil salinity and wind-borne salt.

[7/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan.

[8/] Resistant to silverleaf whitefly.

[9/] Reseeding unlikely at low elevation as plants require a cold period to produce viable seed.

Table C. Critical Area Planting (342)
Suitable Species (Page 1 of 4)

Common Name / Cultivar	Scientific Name	Elevation (ft.)	Rainfall (in.) [1/]	Seeding Rate (lbs/PLS/ac) [2/]
Grasses / Non-legumes				
'aki'aki, totoput, [4/] [8/]	*Sporobolus virginicus*	0 - 1,000	20+	[3/]
annual ryegrasa [5/] [10/]	*Lolium multiflorum*	0 - 7,000	40 - 150	40
Australian saltbush [8/] 'Corto'	*Atriplex semibaccata*	0 - 6,000	20 - 30	20
barley [5/] [8/]	*Hordeum vulgare*	0 - 4,000	40+	70
Baron's grass, paddlegrass, reh padil [4/] [9/] [10/]	*Ischemum polystachyum*	0 – 3,000	50 - 200	[3/]
Bermudagrass [7/] [8/]	*Cynodon dactylon*	0 - 3,000	20 – 100 (-170)	35 [3/]
common				
'NK-37'(giant)				
buckwheat [5/]	*Fagopyrum esculentum*	0 - 4,000	40+	60
centipedegrass [10/]	*Eremochloa ophiuroides*	0 - 2,500	40+	20 [3/]
digitgrass [7/] [9/] 'Mealani' 'Pangola' 'Transvala'	*Digitaria eriantha*	0 - 3,500	50 - 160	[3/]
'emoloa, kawelu [4/]	*Eragrostis variabilis*	0 - 3,500	20 - 80	10
green panicgrass [7/] [10/] 'Petrie'	*Urochloa maxima*	0 - 2,500	25 - 70	20
hairy chess	*Bromus catharticus*	3,000 - 7,000	40 - 100	20
Napiergrass 'Mott'	*Pennisetum purpureum*	0 - 3,000	40+	[3/]
narrowleaf carpetgrass [9/] [10/]	*Axonopus fissifolius*	0 - 5,000	50 – 80 (-160)	40 [3/]
oats [5/]	*Avena sativa*	0 - 7,000	40 - 150	70
orchardgrass	*Dactylis glomerata*	3,000 - 7,000	40 - 100	20
paspalum 'Tropic Lalo'	*Paspalum hieronymii*	0 - 3,000	50 - 150	[3/]
perennial ryegrass	*Lolium perenne*	1,500 - 7,000	40 - 100	40
piligrass [4/]	*Heteropogon contortus*	0 - 2,000	15 – 45 (-90)	10
Rhodesgrass [8/] 'Bell' 'Katambora' 'Nemkat' [7/]	*Chloris gayana*	0 - 3,000	25 - 45	20

Table C. Critical Area Planting (342)
Suitable Species (Page 2 of 4)

Common Name / Cultivar	Scientific Name	Elevation (ft.)	Rainfall (in.) 1/	Seeding Rate (lbs/PLS/ac) 2/
Grasses / Non-legumes (Continued)				
seashore paspalum 8/ 10/ 'Tropic Shore'	*Paspalum vaginatum*	0 - 1,000	40 - 200	3/
stargrass, Puerto Rican 8/ 'Florico'	*Cynodon nlemfuensis*	0 - 3,000	20 - 80	3/
stargrass, South Point 8/	*Cynodon plectostachyus*	0 - 3,000	20 - 80	3/
St. Augustinegrass 8/ 10/	*Stenotaphrum secundatum*	0 - 3,000	40 - 80	3/
vetivergrass 7/ 'Sunshine'	*Chrysopogon zizanioides*	0 – 3,000	35 - 200	3/
wheat 5/ 8/	*Triticum aestivum*	0 - 4,000	40+	70
Legumes				
big trefoil 'Grasslands Maku'	*Lotus pedunculatus*	1,500 - 6,000	50 - 100	20
forage peanut 7/	*Arachis glabrata*	0 - 3,000	50+	3/
forage peanut 'Amarillo' 'Forrajero'	*Arachis pintoi*	0 - 3,000	50+	40 3/
hetero 9/	*Desmodium heterophyllum*	0 - 2,500	60 - 160	20 3/
intortum, desmodium 'Greenleaf' 'Kuiaha'	*Desmodium intortum*	0 - 3,000	60 - 120	20
lablab, dolichos 'Rongai'	*Lablab purpureus*	0 - 4,000	20 - 120	60
nanea, fue sina, beach vigna 4/	*Vigna marina*	0 - 1,000	20+	20 3/
shrubby stylo, 'Seca'	*Stylosanthes scabra*	0 – 3,000	25 - 80	20
Spanish clover, kaimi clover, lattil pako 9/ 10/	*Desmodium incanum*	0 - 3,000	(40-) 60 - 120	20
sunn hemp 5/ 6/ 7/ 'Tropic Sun'	*Crotalaria juncea*	O – 2,500	20+	40
three-flowered 9/ beggarweed	*Desmodium triflorum*	0 - 2,500	60 - 160	3/
white clover 'Grasslands Huia' (NZ) 'Haifa'	*Trifolium repens*	1,500 - 7,000	35 - 80	20

Table C. Critical Area Planting (342)
Suitable Species (Page 3 of 4)

Common Name / Cultivar	Scientific Name	Elevation (ft.)	Rainfall (in.) 1/	Seeding Rate (lbs/PLS/ac) 2/
Ornamental Ground Covers				
‘akia 4/	*Wikstroemia uva-ursi*	0 - 1,000	20+	3/
cape marigold	*Dimorphotheca sinuata*	0 - 3,000	20+	3/
carpet bugle	*Ajuga reptans*	0 - 3,000	30+	3/
day lily	*Hemerocallis aurantiaca*	0 - 4,000	30+	3/
dichondra	*Dichondra repens*	0 - 4,000	30+	3/
‘ilima & ‘ilima papa 4/ (flat ilima)	*Sida fallax*	0 - 6,000	15+	3/
joyweed	*Alternanthera tenella*	0 - 3,000	40+	3/
lippia 8/	*Lippia nodiflora*	0 - 2,500	40+	3/
‘ohai 8/	*Sesbania tomentosa*	0 - 1,000	20 – 40	3/
‘ohelo papa 4/ (wild strawberry)	*Fragaria chiloensis*	0 - 6,000	40+	3/
oyster plant, rhoeo	*Tradescantia spathacea*	0 - 1,000	30+	3/
pa‘uohi‘iaka 4/ 8/	*Jacquemontia ovalifolia*	0 - 1,000	20 – 45	3/
pohinahina, beach vitex 4/ 8/	*Vitex rotundifolia*	0 - 1,000	20+	3/
pohuehue, beach morning glory) 4/ 8/	*Ipomoea pes-caprae*	0 - 1,000	20+	3/
portulaca, moss rose 8/	*Portulaca grandiflora*	0 - 4,000	20+	3/
trailing African daisy	*Osteospermum fruiticosum*	0 - 4,000	40+	3/
‘uhaloa, escobilla sabana 4/	*Waltheria Indica*	0 - 3,500	15+	3/
Waipahu fig	*Ficus tikuoa*	0 - 2,000	40+	3/
Common Name / Cultivar	**Scientific Name**	**Elevation** (ft.)	**Rainfall** (in.) 1/	**Spacing (ft.)**
Woody Plants				
‘a‘ali‘I, lampuye 4/	*Dodonaea viscosa*	0 - 7,000	20+	10 x 10
alahe‘e 4/	*Canthium odoratum*	0 - 3,000	40+	10 x 10
‘aweoweo 4/	*Chenopodium oahuense*	0 - 6,000	20+	6 x 6
bamboo, clumping	*Bambusa* spp.	0 - 3,000	60+	6 x 6
Bermuda juniper	*Juniperus bermudiana*	0 - 3,500	40+	10 x 10
blue vitex, nanulega 8/	*Vitex trifolia* var. *variegata*	0 – 4,000	30+	4 x 4
Bougainvillea, felila 8/	*Bougainvillea spectabilis*	0 - 2,500	25+	10 x 10
Cook pine 8/	*Araucaria columnaris*	0 - 3,000	40+	15 x 15
dracaena	*Dracaena fragrans*	0 - 2,000	50+	6 x 6
dracaena	*Dracaena dermensis*	0 - 2,000	50+	6 x 6
eucalyptus	*Eucalyptus* spp.	0 - 6,000	30+	10 x 10
gliricidia 6/ 9/	*Gliricidia sepium*	0 – 3,000	25+	6 x 6
hala, kafu, fasa, ongor, 4/ 8/ 9/	*Pandanus tectorius*	0 - 500	40+	15 x 15
hibiscus, Chinese, aute, flores rosa	*Hibiscus rosa-sinensis*	0 – 3,000	30+	6 x 6
hibiscus, Hawaiian white 4/	*Hibiscus* spp.	0 - 3,000	30+	6 x 6
ironwood, toa, gagu 6/ 8/ 11/	*Casuarina equisetifolia*	0 – 2,500	30+	10 x 10
kamani, daok, fetau 4/ 8/	*Calophyllum inophyllum*	0 – 500	20+	15 x 15

Table C. Critical Area Planting (342)
Suitable Species (Page 4 of 4)

Common Name / Cultivar	Scientific Name	Elevation (ft.)	Rainfall (in.) 1/	Spacing (ft.)
Woody Plants (Continued)				
koa 4/ 6/	*Acacia koa*	1,500 – 7,000	50+	15 x 15
koai‘a 4/ 6/	*Acacia koaia*	1,000 – 6,000	30+	10 x 10
kou, niyoron 4/ 8/	*Cordia subcordata*	0 – 500	30+	10 x 10
kukui, lama, sakan, candlenut tree 4/ 10/	*Aleurites moluccana*	0 – 2,000	50+	10 x 10
‘kulu‘i 4/	*Nototrichium sandwicense*	0 – 6,000	20+	6 x 6
mamane 4/ 6/	*Sophora chrysophylla*	1,500 – 8,000	30+	10 x 10
manele, soapberry 4/	*Sapindus saponaria*	0 – 4,000	50+	15 x 15
ma‘o, Hawaiian cotton 4/	*Gossypium tomentosum*	0 – 1,000	20+	4 x 4
milo, binalo, rosewood, badrirt, pone 4/ 8/ 10/	*Thespesia populnea*	0 – 500	20+	10 x 10
naio 4/ 8/	*Myoporum sandwicense*	0 – 7,500	30+	10 x 10
naupaka, nanaso 4/ 8/	*Scaevola sericea*	0 – 500	30+	6 x 6
noni, lada, nonu, Indian mulberry, kesengel 4/ 8/ 10/	*Morinda citrifolia*	0 – 1,500	30+	10 x 10
Norfolk Island pine 8/	*Araucaria heterophylla*	0 – 3,000	30+	15 x 15
‘ohai 4/ 6/ 8/	*Sesbania tomentosa* f. *arborea*	0 – 1,000	20 - 40	6 x 6
‘ohi‘a lehua 4/	*Metrosideros polymorpha*	0 – 8,000	60+	10 x 10
pago, fau, hau, ermall, kalau, lo, gaal, kilife 4/	*Hibiscus tiliaceus*	0 - 500	30+	10 x 10
small cone ironwood 6/ 10/	*Casuarina cunninghamiana*	0 – 3,000	30+	10 x 10
ti 4/	*Cordyline fruticosa*	0 – 6,000	30+	4 x 4
‘ulei 4/ 8/	*Osteomeles anthyllidifolia*	0 – 6,000	50+	4 x 4

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client’s conservation plan, planners are required to obtain the PIA State Agronomist’s approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client’s conservation plan.

1/ Unless irrigated.

2/ Pure Live Seed (PLS): The amount of PLS is equal to the percent purity, multiplied by the percent germination. **Double the seeding rates indicated in the table when hydroseeding.**

3/ Species are established with vegetative material. If the material is spread and disked in, use a minimum of 80 bushels of stolons or sprigs per acre. One bushel equals 1.25 cu. ft. For planting sprigs in holes or if using rooted cuttings or seedlings, spacing shall be a maximum of 36 inches apart.

4/ Native or aboriginal introduction.

5/ Use these annuals for rapid cover as a companion plant at one half the indicated per acre rate with a perennial. For rapid temporary cover after land clearing or other disturbance, seed at full rate indicated in table.

6/ Nitrogen fixing.

7/ Resistant to root-knot nematodes.

8/ Tolerant of soil salinity and wind-borne salt.

9/ Tolerates acid, low fertility soils.

10/ Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client’s conservation plan, planners are required to obtain the appropriate PIA State Agronomist’s approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client’s conservation plan.

11 In the PIA West Area, this species is approved for planting because it is native. In American Samoa, this species is considered to be potentially invasive, thus planners are required to obtain the PIA State Agronomist’s approval via email with concurrence from the PIA Plant Materials Specialist in order to include it in a client’s conservation plan. Planners are also required to document the approval/concurrence in the client’s conservation plan. **In the State of Hawaii, this species is not approved for planting** because it is considered to be invasive.

Table D. Grassed Waterway (412)

Suitable Grass Species

Common Name	Scientific Name/Cultivar	Elevation (ft.)	Rainfall (in.) *	Planting Rate
Bermudagrass [2/] [3/]	*Cynodon dactylon*	0 – 3,000	20 – 100 (-170)	35 lbs/PLS/ac [5/]
carpetgrass [1/] [4/]	*Axonopus fissifolius*	0 – 5,000	40 – 80 (-160)	40 lbs/PLS/ac
centipedegrass [4/]	*Eremochloa ophiuroides*	0 – 2,500	40+	20 lbs/PLS/ac
digitgrass [2/]	*Digitaria eriantha,* 'Pangola', 'Transvala'	0 – 3,500	50 - 160	80 bu/ac [6/]
paspalum	*Paspalum hieronymii,* 'Tropic Lalo'	0 – 3,000	50 - 150	80 bu/ac
St. Augustinegrass [3/] [4/]	*Stenotaphrum secundatum*	0 – 3,000	40 - 80	80 bu/ac
zoysiagrass	*Zoysia japonica, 'El Toro'*	0 – 4,000	40 - 100	80 bu/ac

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

* Unless irrigated.

[1/] Tolerant of acid, low fertility soils.

[2/] Resistant to root-knot nematodes.

[3/] Tolerant of soil salinity and wind-borne salt.

[4/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan.

[5/] Pure Live Seed (PLS): The amount of PLS is equal to the percent purity multiplied by the percent germination.

[6/] One bushel equals 1.25 cu. ft.

For rapid temporary cover, seed ryegrass at 10 lbs/PLS/ac or oats at 35 lbs/PLS/ac with the above species.

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Table E. Herbaceous Wind Barriers (603)
Suitable Species (Page 1 of 2)

Common Name/Cultivar	Scientific Name	Adapted Elevation (feet)	Adapted to Annual Rainfall [1/]	Min-Max Plant Spacing (inches w/in row X row)	Planting Material (per 1,000 feet of single row barrier)	Notes
Perennials Effective Height 12- 15 feet						
banagrass	*Pennisetum purpureum*	0 – 3,000	40+	(6-12) X (12-24)	canes--one node overlap Minimum of 2 internodes per cane.	Produces viable seed. Control volunteers. A potential pest in other grass crops. An up-right, tall strain of Napiergrass.
dwarf Brazilian banana, 'Santa Catarina Prata'	*Musa* sp.	0 – 3,500	50+	(60) X (72-120)	corm --201 each	Check State and local regulations about diseases of banana and possible quarantine.
Napiergrass, 'Mott'	*Pennisetum purpureum*	0 – 3,000	40+	(6-12) X (12-24)	canes--one node overlap Minimum of 2 internodes per cane.	Will not volunteer.
Napier x pearl millet hybrid, 'PMN Hybrid'	*Pennisetum purpureum* x *Pennisetum glaucum*	0 – 3,000	40+	(6-12) X (12-24)	canes--one node overlap Minimum of 2 internodes per cane.	Sterile seeds. Will not volunteer.
wild cane hybrid	*Saccharum* hybrid clone *Moentai*	0 – 3,000	35+	(6-12) X (12-24)	canes--one node overlap Minimum of 2 internodes per cane.	Sterile seeds. Will not volunteer. Can require a lot of trimming on lee side. Irrigating minimum amount for effective wind barrier reduces maintenance.
Annuals Effective Height 6 - 8 feet						
corn	*Zea mays*	0 – 4,000	40+	(6-12) X (9-18)	approx. 10 ounces / 1000 ft	Produces viable seed. Control volunteer. Recommend double row.
forage sorghum hybrids	*Sorghum bicolor*					Recommend double row for all forage sorghum hybrids.
'Garrison Bale-all III'		0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Sterile – Separate from other Sorghum by ¼ mile to prevent cross-pollination.

Table E. Herbaceous Wind Barriers (603)
Suitable Plant Species (Page 2 of 2)

Common Name/Cultivar	Scientific Name	Adapted Elevation (feet)	Adapted to Annual Rainfall [1/]	Min-Max Plant Spacing (inches w/in row X row)	Planting Material (per 1,000 feet of single row barrier)	Notes
Annuals Effective Height 6 - 8 feet						
sorghum x sudan hybrids [2/]	*Sorghum bicolor* x *S. bicolor* var. *sudanese*					Recommend double row for all sorghum-sudan hybrids.
'DeKalb ST-6E'		0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Sterile – Separate from other Sorghum by ¼ mile to prevent cross-pollination.
'Dekalb SX-17+'	.	0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Sterile – Separate from other Sorghum by ¼ mile to prevent cross pollination.
'Funk 83-F'	.	0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Produces viable seed. Control volunteers.
'Germain Bravo'		0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Produces viable seed. Control volunteers.
'Germain SS-222'		0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Produces viable seed. Control volunteers.
Taylor Evans 'T-E Goldmaker'	.	0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Sterile – Separate from other Sorghum by ¼ mile to prevent cross-pollination.
'T-E Haygrazer'	.	0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Produces viable seed. Control volunteers.
'Warner Sweet Bee Sterile II'	.	0 – 2,500	40+	(3-6) X (9-18)	approx. 1.5 pounds/ 1000 ft	Sterile – Separate from other Sorghum by ¼ mile to prevent cross-pollination.

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

[1/] May require irrigation for establishment and during dry season.

[2/] Resistant to root-knot nematodes.

Table F. Pasture and Hay Planting (512)
Suitable Grass and Legume Species (Page 1 of 2)

Species	Rainfall Range (inches)	Elevation Range (feet)	Seeding Rate [1] (lbs PLS/ac)
Grasses/Cultivars			
alfalfa (*Medicago sativa)* 'CUF-101', 'Moapa 69' [8], 'WL-605', 'WL-656', 'WL-711WF' [8] [11]	50 - 100+	0 - 4,000	20
Bermudagrass [8] [9]: 'NK-37' (giant) (*Cynodon dactylon*)	20 – 100 (-170)	0 - 3,000	5
buffelgrass [8] : 'T-4464', 'Gayndah' *(Cenchrus ciliaris*)	12 - 35	0 - 1,000	5
'Biloela', 'Nueces'	12 - 35	0 - 1,500	5
'Molopo'	12 - 35	0 - 3,000	5
'emoloa, kawelu, lovegrass [13] (*Eragrostis variabilis*)	20 - 80	0 - 3,500	5
green panicgrass [8] [10]: 'Petrie' *(Urochloa maxima*)	25 - 70	0 - 2,500	5
guineagrass [10]: 'Natsukazi' (*Urochloa maxima*)	35 - 100+	0 - 2,500	5
orchardgrass (*Dactylis glomerata*)	40 - 100	3,000 - 7,000	10
perennial ryegrass: 'Linn', 'Tetraploid' *(Lolium perenne*)	40 - 100	1,500 - 7,000	20
piligrass [3] (*Heteropogon contortus)*	15 – 45 (-90)	0 - 2,000	5
Rhodesgrass [9]: 'Bell', 'Katambora', 'Nemkat' [8] (*Chloris gayana*)	25 - 45	0 - 3,000	5
signalgrass [9]: 'Basilick', 'Mulato', 'Mulato II' (*Urochloa brizantha*) (*Urochloa* spp. hybrids)	50 - 120	0 - 3,000	8
Legumes/Cultivars [4]			
big trefoil: 'Grasslands Maku' (*Lotus pedunculatus*)	50 - 100	1,500 - 6,000	5
Intortum, desmodium: 'Greenleaf', 'Kuiaha' (*Desmodium intortum*)	60 - 120	0 - 3,000	5
shrubby stylo [14]: 'Seca'	25 - 80	0 – 3,000	5
Spanish clover, kaimi clover, lattil pako [10] [14] (*Desmodium incanum)*	(40-) 60 - 120	0 - 3,000	5
white clover [5]: 'Haifa', 'Grasslands Huia' (*Trifolium repens*)	35 - 80	1,500 - 7,000	5

Table F. Pasture and Hay Planting (512)
Suitable Grass and Legume Species (Page 2 of 2)

Species	Rainfall Range (inches)	Elevation Range (feet)	Planting Rate
Grasses Normally Established Vegetatively			
Baron's grass, paddlegrass, reh padil [10/] [12/] [14/] [15/] (*Ischaemum polystachyum*)	50 - 200	0 – 3,000	*
digitgrass [8/] [14/]: 'Mealani', 'Pangola' (*Digitaria eriantha)*	50 - 160	0 - 3,500	*
Limpograss [15/]: 'Bigalta' (*Hemarthria altissima*)	60+	0 - 4,000	*
Napiergrass: 'Mott' [7/] (*Pennisetum purpurem*)	40+	0 - 3,000	*
stargrass, Puerto Rican [9/]: 'Florico' (*Cynodon nlemfuensis*)	20 - 80	0 - 3,000	*
stargrass, South Point [9/] (*Cynodon plectostachyus*)	20 - 80	0 - 3,000	*

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Range Management Specialist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

* For hand planting or planting in furrows, place stolons in ground at maximum spacing of 6'X6'.

* For disked-in plants, use 40 bushels [6/] of material per acre.

[1/] Minimum seeding rate, PLS (Pure Live Seed).

[2/] Seed commercially available with required federal permit. Permit forms are available from commercial seed suppliers.

[3/] Native to PIA. . Piligrass seeds and awns may be harmful to animal mouth parts.

[4/] Legumes must be inoculated with the correct *Rhizobium* culture before seeding.

[5/] Will not tolerate highly acid soils (stronger than pH 5.5).

[6/] One bushel equals 1.25 cu.ft.

[7/] Suitable for grazing, cut and carry and green chop. Not well suited to haying.

[8/] Resistant to root-knot nematodes.

[9/] Tolerant of soil salinity and wind-borne salt.

[10/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State Range Management Specialist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan.

[11/] Resistant to silverleaf whitefly.

[12/] Native to PIA West Area.

[13/] Endemic to Hawaii.

[14/] Tolerates acid, low-fertility soils.

[15/] Tolerates wet soil conditions.

Table G. Range Planting (550)
Suitable Grass and Legume Species (Page 1 of 2)

Species	Rainfall Range (inches)	Elevation Range (feet)	Seeding Rate [1/] (lbs PLS/ac)
Grasses/Cultivars			
buffelgrass [7/]: 'T-4464', 'Gayndah' (*Cenchrus ciliaris*)	12 - 35	0 - 1,000	2
'Biloela', 'Nueces'	12 - 35	0 - 1,500	2
'Molopo'	12 - 35	0 - 3,000	2
'emoloa, kawelu, lovegrass [11/] (*Eragrostis variabilis*)	15 - 80	0 - 3,500	2
giant bermudagrass [7/] [8/]: 'NK-37' (*Cynodon dactylon*)	20 – 100 (-170)	0 - 3,000	2
green panicgrass [7/] [9/]: 'Petrie' (*Urochloa maxima*)	25 - 70	0 - 2,500	2
guineagrass [9/]: 'Natsukazi' (*Urochloa maxima*)	35 - 100+	0 - 2,500	2
orchardgrass (*Dactylis glomerata*)	40 - 100	3,000 - 7,000	4
perennial ryegrass: 'Linn', 'Tetraploid' (*Lolium perenne*)	40 - 100	1,500 - 7,000	5
piligrass [3/] (*Heteropogon contortus*)	15 – 45 (-90)	0 - 2,000	2
Rhodesgrass [8/]: 'Bell', 'Katambora', 'Nemkat' [7/] (*Chloris gayana*)	25 - 45	0 – 3,000	2
signalgrass [8/]: 'Basilick', 'Mulato', 'Mulato II' (*Urochloa brizantha*) (*Urochloa* spp. hybrids)	50 - 120	0 - 3,000	3
Legumes/Cultivars [4/]			
big trefoil: 'Grasslands Maku' (*Lotus pedunculatus*)	50 - 100	1,500 - 6,000	2
intortum, desmodium: 'Greenleaf', 'Kuiaha' (*Desmodium intortum)*	60 - 120	0 - 3,000	2
shrubby stylo [12/]: 'Seca'	25 - 80	0 – 3,000	2
Spanish clover, kaimi clover, lattil pako [9/] [12/] (*Desmodium incanum*)	(40-) 60 - 120	0 – 3,000	2
white clover [5/]: 'Haifa', 'Grasslands Huia' (*Trifolium repens*)	35 - 80	1,500 - 7,000	2

Table G. Range Planting (550)
Suitable Grass and Legume Species (Page 2 of 2)

Species	Rainfall Range (inches)	Elevation Range (feet)	Planting Rate
Grasses Normally Established Vegetatively			
Baron's grass, paddlegrass, reh padil [9/] [10/] [12/] [13/] (*Ischaemum polystachyum*)	50 - 200	0 – 3,000	*
digitgrass [7/] [12/]: 'Mealani', 'Pangola' (*Digitaria eriantha)*	50 - 160	0 - 3,500	*
limpograss [13/]: 'Bigalta' (*Hemarthria altissima*)	60+	0 - 4,000	*
Napiergrass: 'Mott' (*Pennisetum purpureum*)	40+	0 - 3,000	*
stargrass, Puerto Rican [8/]: 'Florico' *(Cynodon nlemfuensis*)	20 - 80	0 - 3,000	*
stargrass, South Point [8/] (*Cynodon plectostachyus*)	20 - 80	0 - 3,000	*

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Range Management Specialist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

* For hand planting or planting in furrows, place sprigs in ground at maximum spacing of 6'X6'.

* For disced-in plants, use 40 bushels [6/] of material per acre.

[1/] Minimum seeding rate, PLS (Pure Live Seed).

[2/] Seed commercially available with required federal permit. Permit forms are available from commercial seed suppliers.

[3/] Native to PIA. . Piligrass seeds and awns may be harmful to animal mouth parts.

[4/] Legumes must be inoculated with the correct *Rhizobium* culture before seeding.

[5/] Will not tolerate highly acid soils (stronger than pH 5.5).

[6/] One bushel equals 1.25 cu.ft.

[7/] Resistant to root-knot nematodes.

[8/] Tolerant of soil salinity and wind-borne salt.

[9/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State Range Management Specialist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan.

[10/] Native to PIA- West Area.

[11/] Endemic to Hawaii.

[12/] Tolerates acid, low-fertility soils.

[13/] Tolerates wet soil conditions.

Table H. Recreation Area Improvement (562)
Suitable Grass Species (Page 1 of 1)

Species/Cultivar	Shady Areas	Shoreline / Salty Areas	Normal Use Areas	Heavy Use Areas	Natural/ Unmowed Areas
'aki'aki, totoput [3/] [4/] (*Sprobolus virginicus*)		X	X		X
Bermudagrass [1/] [4/] (*Cynodon dactylon*)		X	X	X	
centipedegrass [2/] (*Eremochloa ophiuroides*)	X		X		
'emoloa, kawelu [5/] (*Eragrostis variabilis*)					X
paspalum 'Tropic Lalo' (*Paspalum hieronymii*)			X	X	
piligrass, tanglehead [3/] (*Hetropogon contortus*)					X
Rhodesgrass [4/] 'Bell', 'Katambora', 'Nemkat' [1/] (*Chloris gayana*)					X
seashore paspalum [2/] [4/] 'Tropic Shore' (*Paspalum vaginatum*)		X	X		X
St. Augustinegrass [2/] [4/] (*Stenotaphrum secondatum*)	X	X	X		
zoysiagrass [4/] 'El Toro' (*Zoysia japonica*)	X	X	X		

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA Plant Materials Specialist's approval via email. Planners are also required to document the approval/concurrence in the client's conservation plan.

[1/] Resistant to root-knot nematodes.

[2/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the PIA Plant Materials Specialist's approval via email. Planners are also required to document the approval /concurrence in the client's conservation plan.

[3/] Native to PI.

[4/] Tolerant of soil salinity and wind-borne salt

[5/] Endemic to Hawaii.

Table I. Recreation Area Improvement (562)
Suitable Tree and Shrub Species (Page 1 of 1)

Species	Scientific Name	Ornamental	Xeriscape	Shade	Hedge/Screen	Windbreak
‘a‘ali‘i, lampuye [2/]	*Dodonaea viscosa*	X	X		X	X
‘akia [2/]	*Wikstromia uva-ursi*	X	X			
alahe‘e [2/]	*Canthium odoratum*	X	X		X	X
areca palm	*Chrysalidocarpus lutescens*	X			X	X
Bougainvillea [1/]	*Bougainvillea spectabilis*	X	X		X	
breadfruit, ulu [2/]	*Artocarpus communis*	X		X		X
Cook pine [1/]	*Araucara columnaris*	X				X
croton	*Codium variegatum*	X			X	X
eucalyptus	*Eucalyptus* spp.	X		X		X
false kamani, talie [2/]	*Terminalia catappa*	X		X		X
hala, ongor, fasa [1/ 2/]	*Pandanus tectorius*	X		X		X
hibiscus, aute [2/]	*Hibiscus* spp.	X			X	X
Ipil, ifilele, ifit, dort [2/]	*Intsia bijuga*	X		X		X
kamani, daok [1/ 2/]	*Calophyllum inophyllum*	X		X		X
koa [2/]	*Acacia koa*			X		X
koai‘a [2/]	*Acacia koaia*		X	X		X
kou, niyoron [1/ 2/]	*Cordia subcordata*	X	X	X		X
kukui, lama [2/ 3/]	*Aleurites moluccana*	X		X		X
loulu palm [2/]	*Pritchardia* spp.	X	X			X
manele, soapberry [2/]	*Sapindus saponaria*			X		X
ma‘o [2/]	*Gossypium sandwicense*	X	X			
milo, binalo [1/ 2/ 3/]	*Thepesia populnea*	X	X	X		X
monkeypod	*Samanea saman*	X		X		
naio [1/ 2/]	*Myoporum sandwicense*	X	X		X	X
Naupaka, nanaso [1/ 2/]	*Scaevola sericea*	X	X		X	X
‘ohi‘a lehua [2/]	*Metrosideros polymorpha*	X		X		X
pink tecoma, trumpet	*Tabebuia* spp.	X		X		X
plumeria	*Plumeria* spp.	X		X		
shower tree	*Cassia* spp.	X		X		X
ti [2/]	*Cordyline fruticosa*	X			X	X
‘ulei [1/ 2/]	*Osteomeles anthyllidifolia*	X	X			

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client’s conservation plan, planners are required to obtain the PIA Plant Materials Specialist’s approval via email. Planners are also required to document the approval/concurrence in the client’s conservation plan.

[1/] Tolerant of soil salinity and wind-borne salt.

[2/] Native or aboriginal introduction.

[3/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client’s conservation plan, planners are required to obtain the PIA Plant Materials Specialist’s approval via email. Planners are also required to document the approval /concurrence in the client’s conservation plan.

Riparian Forest Buffer (391)
Species Selection

To select suitable species for riparian forest buffer use the Pacific Island Plant Restoration Database, a management tool for habitat restoration in the Pacific Islands. The program can accessed via the internet at: http://hawaiiconservation.org/piprd.asp.

Note: The database is not all-inclusive. In order to include other species (not listed in the database) in a client's conservation plan, planners are required to obtain the PIA State Forest Ecologist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

To help ensure against loss of buffer due to fire, insects, diseases, and other destructive forces, and to ensure survival it is advisable to plant a variety of species with a variety of short and tall growth habits.

Species selected must be appropriate for the existing bank slope.

Species selected must also be appropriate for its intended purpose. If the sole purpose is to reduce sedimentation or nutrients, consider using an herbaceous planting practice if the existing cover is less than 75 percent.

Refer to the Riparian Forest Buffer Specification (Section IV FOTG) for information about buffer width and installation procedures.

Table J. Tree/Shrub Establishment (612)
Suitable Tree and Shrub Species (Page 1 of 1)

Species	Scientific Name	Elevation (1000')	Rainfall [1/] (inches)	Spacing in Feet	
				Minimum	Maximum
Height Class < 35'					
koai'a [2/] [3/]	*Acacia koaia*	0 – 2.5	20	6 x 6	12 x 12
kou, tauanave, galu, niyoron, koa, kalau, ikoik, ikoak, anau [2/]	*Cordia subcordata*	0 - .5	20+	10 x 10	20 x 20
mamane [2/] [3/]	*Sophora chrysophylla*	1.5 - 8	30+	6 x 6	12 x 12
milo, binalo, banalo, bang-beng, kilulo, rosewood, badrirt, panu, polo, pone [2/] [4/] [5/]	*Thespesia populnea*	0 - .5	20+	10 x 10	20 x 20
noni, nonu, lada, i, kesengel, nen, mangal'wag, Indian mulberry [2/] [4/] [5/]	*Morinda citrifolia*	0 – 1.5	30+	6 x 6	12 x 12
Height Class > 35'					
Cook pine [4/]	*Araucaria columnaris*	0 - 3	30+	10 x 10	20 x 20
ifit, ifil, ipil, ifilele, choyo, dort, kubok, kuren [2/]	*Intsia bijuga*	0 – 1.5	60+	10 x 10	20 x 20
kamani, daok, fetau, btaches, biyuch, eet, isou, lueg, rakich [2/] [4/]	*Calophyllum inophyllum*	0 – .5	20+	8 x 8	20 x 20
koa [2/] [3/]	*Acacia koa*	1.5 - 7	60+	8 x 8	20 x 20
mahogany	*Swietenia mahagoni, Swietenia macrophylla*	0 - 1	40+	10 x 10	20 x 20
monkeypod, filinganga, gumorni, tamalini [3/]	*Samanea saman*	0 - 1	40+	8 x 8	20 x 20
Neem [5/]	*Azadirachta indica*	0 - 1	30+	10 x 10	20 x20
Norfolk Island pine [4/]	*Araucaria heterophylla*	0 - 3	30+	10 x 10	20 x 20
'ohi'a lehua [2/]	*Metrosideros polymorpha*	0 - 8	60+	8 x 8	20 x 20
poumuli	*Flueggea flexuosa*	0 -1	60+	10 x 10	20 x 20

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Forest Ecologist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

[1/] Unless irrigated.

[2/] Native or aboriginal introduction

[3/] Nitrogen fixing tree.

[4/] Tolerant of soil salinity and wind-borne salt.

[5/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State Forest Ecologist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan.

Table K. Upland Wildlife Habitat Management (645)

Typical Vegetation Used for Food, Nesting Cover, and Escape Cover (Page 1 of 1)

Common Name	Scientific Name
piligrass	*Heteropogon contortus*
‘a’ali’i, lampuye	*Dodonaea viscosa*
‘akia	*Wikstroemia* sp.
‘ilima	*Sida fallax*
mamani	*Sophora chrysophylla*
‘ohelo	*Vaccinium reticulatum*
popolo	*Solanum americanum*
pukiawe	*Styphelia tameiameiae*
‘uhaloa, escobilla sabana	*Waltheria indica*

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client’s conservation plan, planners are required to obtain the PIA State Biologist’s approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client’s conservation plan.

Table L. Vegetative Barrier (601)
Suitable Species (Page 1 of 1)

Common Name/Cultivar	Scientific Name	Approximate Stem Diameter (in.)	Approximate Mature Height (ft.)	Adapted Elevation (ft.)	Adapted to Annual Rainfall [1/]
banagrass [2/]	*Pennisetum purpureum*	0.83	15	0 - 3,000	40+
greenpanicgrass [2/] [5/] [7/]	*Urochloa maxima*	0.19	5	0 - 2,500	25 - 70
lemongrass	*Cymbopogon citratus*	0.19	4	0 - 4,000	50+
Napiergrass 'Mott' [4/]	*Pennisetum purpureum*	0.55	12	0 - 3,000	40+
Napier x pearl millet hybrid [4/] 'PMN Hybrid'	*Pennisetum purpureum* x *Pennisetum glaucum*	0.53	12 - 15	0 - 3,000	40+
piligrass [2/] [3/]	*Heteropogon contortus*	0.18	5	0 - 2,000	15 – 45
Rhodesgrass [2/] [6/] 'Bell', 'Katambora', 'Nemkat' [5/]	*Chloris gayana*	0.19	5	0 - 3,000	25 – 45
vetivergrass [5/] [6/] 'Sunshine' [4/]	*Chrysopogon zizanioides*	0.36	8	0 - 3,000	35+
wild cane hybrid [4/]	*Saccharum* hybrid clone *Moentai*	0.70	15	0 - 3,000	35+

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

[1/] Irrigation required if average annual precipitation is below specified amount or as needed for normal growth.

[2/] Spreads by windblown seed. Control measures may be needed on cropland if plants are allowed to produce viable seed.

[3/] Native.

[4/] Sterile seeds. Will not volunteer.

[5/] Resistant to root-knot nematodes.

[6/] Tolerant of soil salinity and wind-borne salt.

[7/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the appropriate PIA State Agronomist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client's conservation plan.

Table M. Wetland Wildlife Habitat Management (644)
Wetland Species Preferred by Water and Migratory Birds (Page 1 of 1)

Plant Species	Edible Parts	Habitat
Cyperus javanicus (marsh cyperus)	Nuts	Coastal marshes, taro loʻi
Cyperus polystachyos	Nuts	Freshwater to brackish
Echinochloa crus-galli (barnyardgrass)	Inflorescence, leaves	Freshwater, taro loʻi
Echinochloa colona (jungle rice)	Inflorescence, leaves	Freshwater
Eleocharis geniculata (spike rush)	Nuts	Freshwater
Eragrostis spp.	Inflorescence	Freshwater to brackish
Fimbristylis sp.	Nuts	Freshwater to brackish
Scirpus sp.	Nuts, stems	Most species are freshwater
Scleria spp.	Nuts	Freshwater to brackish

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client's conservation plan, planners are required to obtain the PIA State Biologist's approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan.

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Table N. Windbreak/Shelterbelt Establishment (380)
Suitable Species (Page 1 of 3)

Common Name	Scientific Name	Relative Growth Rate	Approx. 20-year Height (feet)	Adaptation	
				Elevation (feet)	Rainfall [1/] (inches)
Height Class Short (S)= height to 25 feet (spacing between plants within row: 2 to 6 feet)					
‘a‘ali‘I, lampuye [8/]	*Dodonaea viscosa*	Moderate	10	0 - 7,000	20+
alahe‘e [8/]	*Canthium odoratum*	Moderate	15	0 - 3,000	40+
beach heliotrope, hunig [10/]	*Tournefortia argentea*	Moderate	20	0 - 1,000	30+
beefsteak	*Acalypha wilkensiana* var. *marginata*	Rapid	15	0 - 4,000	30+
blue vitex, nanulega [10/]	*Vitex trifolia* var. *variegata*	Rapid	15	0 - 4,000	30+
croton	*Codium variegatum*	Slow	15	0 - 2,500	40+
dracaena	*Dracaena fragrans or D. dermensis*	Moderate	15	0 - 2,000	50+
dwarf brassaia	*Schefflera arboricola*	Rapid	20	0 - 1,000	30+
heen naran (sdy. tangerine)	*Citrus lycopersicaeformis*	Slow	15	0 - 1,500	30+
hibiscus, Chinese, aute	*Hibiscus rosa-sinensis*	Moderate	15	0 - 3,000	30+
hibiscus, Hawaiian white [5/]	*Hibiscus* spp.	Moderate	15	0 - 3,000	30+
naio [8/ 10/]	*Myoporum sandwicense*	Slow	15	0 - 7,500	30+
naupaka, nanaso [8/ 10/]	*Scaevola sericea*	Moderate	10	0 - 1,000	30+
noni, nonu, lada, Indian mulberry, kesengel [8/ 10/ 11/]	*Morinda citrifolia*	Moderate	20	0 - 1,500	30+
oleander, oliana [2/ 10/]	*Nerium oleander*	Rapid	15	0 - 3,000	30+
panax, tanitani [9/]	*Polyscias guilfoylei*	Moderate	25	0 - 2,000	30+
shell ginger	*Alpinia zerumbet*	Moderate	10	0 - 2,500	40+
ti [8/]	*Cordyline fruticosa*	Moderate	10	0 - 6,000	30+
Height Class Medium (M)= height 25 to 40 feet (spacing between plants within row: 3 to 10 feet)					
ahgao, aloalo, topwuk, fienkack, nior, false elder [8/]	*Premna obtusifolia*	Moderate	25	0 -1,000	50+
Australian brush-cherry	*Syzygium paniculatum*	Moderate	25	0 – 3,000	50+
areca palm	*Chrysalidocarpus lutescens*	Slow	25	0 - 2,000	40+
avocado [3/]	*Persea americana*	Moderate	30	0 - 2,000	30+
breadfruit, ulu, lemai [8/]	*Artocarpus altilis*	Slow	40	0 - 1,000	40+
copalchi croton	*Croton reflexifolius*	Moderate	30	0 - 2,500	40+
dwarf coconut palm, niu, nu lius, iru, lu, ni, niyog, nizok	*Cocos nucifera*	Slow	30	0 - 1,500	20+
fishtail palm	*Caryota mitis*	Moderate	40	0 - 1,000	60+
gliricidia, madre de cacao [7/]	*Gliricidia sepium*	Rapid	30	0 - 3,000	25+
hala, ongor, fasa [8/ 10/]	*Pandanus tectorius*	Moderate	30	0 - 500	40+
koai‘a [7/ 8/]	*Acacia koaia*	Moderate	25	0 - 2,500	20+
kou, tauanave, niyoron [8/ 10/]	*Cordia subcordata*	Moderate	35	0 - 500	20+

Table N. Windbreak/Shelterbelt Establishment (380)
Suitable Species (Page 2 of 3)

Common Name	Scientific Name	Relative Growth Rate	Approx. 20-year Height (feet)	Adaptation	
				Elevation (feet)	Rainfall [1] (inches)
Macarthur palm	*Ptychosperma macarthurii*	Slow	30	0 - 2,000	20+
mamane [5] [7]	*Sophora chrysophylla*	Moderate	40	1,500 - 8,000	30+
milo, binalo, rosewood, badrirt, banalo, kilulo, panu, polo, pone, bang-beng [8] [10] [11]	*Thespesia populnea*	Moderate	35	0 - 500	20+
podocarpus fern pine [3]	*Podocarpus gracilior*	Moderate	40	0 - 1,500	60+
seagrape [10]	*Coccoloba uvifera*	Moderate	25	0 - 1,000	30+
Height Class Tall (T)= height greater than 40 feet (spacing between plants within row: 6 to 15 feet)					
brushbox	*Lophostemon confertus*	Rapid	60	0 - 3000	40+
callitris	*Callitris* spp.	Slow	100	100 - 2000	50+
Chinese fir	*Cunninghamia lanceolata*	Moderate	80	2,000 - 6,000	40+
coconut palm, niu, lius, iru, lu, ni, niyog, nizok, nu [8] [10]	*Cocos nucifera*	Slow	60	0 - 1,500	20+
Cook pine [10]	*Araucaria columnaris*	Moderate	100	0 - 3,000	30+
false kamani, talie, talisai, miich, tropical almond [8] [10]	*Terminalia catappa*	Moderate	85	0 – 1,000	40+
ferntree	*Filicium decipiens*	Moderate	45	0 - 1,000	60+
ifit, ifil, ipil, ifilele, choyo, dort, kubok, kuren [8] [13]	*Intsia bijuga*	Moderate	50	0 – 1,500	60+
ironwood, toa, gagu, laash, ngas, mejinoki, weeku [7] [10] [12]	*Casuarina equisetifolia*	Rapid	70	0 – 2,500	30+
Italian cypress	*Cupressus sempervirens*	Slow	60	0 - 4,000	30+
jackfruit	*Artocarpus heterophyllum*	Moderate	50	0 - 3,000	60+
Japanese sugi pine	*Cryptomaria japonica*	Moderate	70	1,500 - 6,000	50+
kamani, daok, btaches, fetau, biyuch, eet, isou, lueg, rakich [8] [10]	*Calophyllum inophyllum*	Slow	60	0 - 500	20+
koa [5] [7]	*Acacia koa*	Slow	75	1,500 - 7,000	50+
kukui, lama, lumbang, sakan, raguar, candlenut tree [4] [8] [11]	*Aleurites moluccana*	Moderate	50	0 - 2,000	30+
Lawson's cypress	*Chamaecyparis lawsoniana*	Moderate	50	2,500 - 6,000	40+
mahogany [10]	*Swietenia mahagoni*	Slow	60	0 - 1,000	40+
mahogany (broad-leaved)	*Swietenia macrophylla*	Moderate	60	0 - 1,000	40+
manele, soapberry [8]	*Sapindus saponaria*	Moderate	60	0 - 4,000	50+

Table N. Windbreak/Shelterbelt Establishment (380)
Suitable Species (Page 3 of 3)

Common Name	Scientific Name	Relative Growth Rate	Approx. 20-year Height (feet)	Adaptation	
				Elevation (feet)	Rainfall [1/] (inches)
mango, kangit, idele, mago, mangueira	*Magnifera indica*	Slow	60	0 - 2,000	40+
Monterey cypress [6/]	*Cupressus macrocarpa*	Slow	70	1,500 - 5,000	40+
Norfolk Island pine [10/]	*Araucaria heterophylla*	Moderate	100	1,500 - 3,000	30+
‘ohi‘a lehua [8/]	*Metrosideros polymorpha*	Slow	80	0 - 8,000	60+
pink tecoma	*Tabebuia heterophylla*	Moderate	45	0 - 500	20+
Portuguese (Mexican) cypress	*Cupressus lusitanica*	Moderate	45	0 - 3,000	40+
poumuli	*Flueggea flexuosa*	Moderate	45	0 – 1,000	60+
small cone ironwood [7/ 11/]	*Casuarina cunninghamiana*	Rapid	70	0 - 3,000	30+
tamarind [7/ 10/]	*Tamarindus indica*	Slow	75	0 - 1,000	30+
turpentine tree	*Syncarpia glomulifera*	Moderate	70	0 - 2,000	40+

Note: This list is not all-inclusive. In order to include other species (not listed in the above table) in a client’s conservation plan, planners are required to obtain the PIA State Forest Ecologist’s approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client’s conservation plan.

[1/] Minimum moisture requirement.
[2/] Sap is poisonous.
[3/] Must be grown from seed for windbreak use. May need staking the first year.
[4/] May break branches during high winds.
[5/] Endemic to Hawaii.
[6/] Use in deeper soils only.
[7/] Nitrogen fixing tree.
[8/] Native or aboriginal introduction.
[9/] Ground termites can get into the dead wood portion of the stem.
[10/] Tolerant of soil salinity and wind-borne salt.
[11/] Potentially invasive species (see Introduction page 1). In order to include potentially invasive species in a client’s conservation plan, planners are required to obtain the appropriate PIA State Agronomist’s approval via email with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval /concurrence in the client’s conservation plan.
[12/] In the PIA West Area, this species is approved for planting because it is native. In American Samoa, this species is considered to be potentially invasive, thus planners are required to obtain the PIA State Forest Ecologist’s approval via email with concurrence from the PIA Plant Materials Specialist in order to include it in a client’s conservation plan. Planners are also required to document the approval/concurrence in the client’s conservation plan. **In the State of Hawaii, this species is not approved for planting** because it is considered to be invasive.

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Table O. List of Plant Pictures by Scientific Name

Table O. List of Plant Pictures by Scientific Name

Scientific Name	Common Name	Page
Sunshine (syn. *Vetiveria zizanioides*)		
Cibotium menziesii	hapu‘u, tree fern	51
Citrus lycopersicaeformis	heen naran (seedy tangerine)	51
Coccolba uvifera	sea grape	51
Cocos nucifera	coconut, niu, lius, iru, lu, ni, niyog, nizok, nu	52
Cocos nucifera	dwarf coconut, niu, lius, iru, lu, ni, niyog, nizok, nu	52
Codium variegatum	croton	52
Coix lachryma	jobs tears	52
Cordia subcordata	kou, niyoron, tauanave, galu, koa, kalau, ikoik, ikoak, anau	52
Cordyline fruticosa	ti	52
Crotalaria juncea cv. Tropic Sun	sunn hemp	52
Croton reflexifolius	colpachi croton	53
Cryptomaria japonica	Japanese sugi pine	53
Cunninghamia lanceolata	Chinese fir	53
Cupressus lusitanica	Portuguese (Mexican) cypress	53
Cupressus macrocarpa	California cypress	53
Cupressus sempervirons	Italian cypress	53
Cymbopogon citratus	lemongrass	53
Cynodon dactylon	common Bermudagrass	53
Cynodon dactylon	giant Bermudagrass	53
Cynodon nlemfuensis cv. Florico	Puerto Rican stargrass	54
Cyperus javanicus	‘ahu‘awa, marsh cypress	54
Cyperus polystachyos		54
Dactylis glomerata	orchardgrass	54
Desmodium heterophyllum	hetero	54
Desmodium intortum (or *Desmodium aparines*)	intortum, desmodium	54
Desmodium triflorum	three-flower beggarweed	54
Dichondra repens	dichondra	54
Digitaria eriantha cv. Pangola	digitgrass	54
Digitaria eriantha cv. Transvala	digitgrass	55
Dimorphotheca sinuata	cape marigold	55
Dodonaea viscosa	‘a‘ali‘i, lampuye	55
Dracaena fragans	dracaena	55
Echinochloa colona	jungle rice	55
Echinochloa crus-galli	barnyardgrass	55
Eleocharis geniculata	spike rush	55

Table O. List of Plant Pictures by Scientific Name

Scientific Name	Common Name	Page
Eragrostis variabilis	‘emoloa, kawelu, lovegrass	55
Eremochloa ophiuroides	centipedegrass	56
Erythrina sandwicensis	wiliwili	56
Erythrina variegata cv. Tropic Coral	tall erythrina	56
Eucalyptus camaldulensis	river-redgum eucalyptus	56
Eucalyptus dunnii	Dunn’s eucalyptus	56
Eucalyptus robusta	swamp mahogany	56
Eucalyptus torreliana	cadaga	56
Fagopyrum esculentum	buckwheat	56
Filicium decipiens	ferntree	57
Fimbristylis littoralis		57
Flueggea flexuosa	poumuli	57
Fragaria chiloensis	‘ohelo papa	57
Gliricidia sepium	gliricidia, madra de cacao	57
Glycine max	soybean	57
Gossypium tomentosum	ma‘o, Hawaiian cotton	57
Hemarthria altissima cv. Bigalta	limpograss	57
Hemerocallis aurantiaca	day lily	57
Hetropogon contortus	piligrass, tanglehead	58
Hibiscus arnottianus var. *punaluensis*	Oahu white hibiscus	58
Hibiscus rosa-sinensis	hibiscus, Chinese, aute, flores rosa	58
Intsia bijuga	ifit, ifil, ipil, ifilele, dort, choyo, kubok, kuren	58
Ipomea pes-caprae	pohuehue, beach morning glory	58
Ischaemum polystachyum (syn. *Ischaemum digitatum*)	Baron’s grass, paddlegrass, reh padil	58
Jacquemontia ovalifolia subsp. *sandwicensis*	pa‘uohi‘iaka	58
Juncus effusus	soft rush	58
Lablab purpureus	lablab	58
Lippia nodiflora	lippia	59
Lolium multiflorum	annual ryegrass	59
Lolium perenne	perennial ryegrass	59
Lophostemon confertus (syn. *Tristania conferta*)	brushbox	59
Lotus pedunculatus	big trefoil	59
Lycium sandwicense	‘ohelo kai	59
Magnifera indica	mango, kangit, idele, mago,	59

Table O. List of Plant Pictures by Scientific Name

Scientific Name	Common Name	Page
	mangueira	
Medicago sativa	alfalfa	59
Melitotus sp.	sweet clover	59
Metrosideros polymorpha	‘ohi‘a lehua	60
Morinda citrifolia	noni, lada, nonu, kesengel, i, nen, mangal’wag, Indian mulberry	60
Musa sp. cv. Santa Catarina Prata	dwarf Brazilian banana	60
Myoporum sandwicense	naio	60
Nerium oleander	oleander, oliana	60
Opuntia ficus-indica	panini, prickly pear cactus	60
Oryza sativa	rice	60
Osteomeles anthyllidifolia	‘ulei	61
Osteospermum fruticosum	trailing African daisy	61
Pandanus tectorius	hala, kafu, fasa, ongor	61
Paspalum hieronymii cv. Tropic Lalo	paspalum	61
Paspalum orbiculare	mau‘u laiki, ricegrass	61
Paspalum vaginatum	seashore paspalum	61
Pennisetum purpureum cv. Mott	Napiergrass	61
Pennisetum purpureum x *Pennisetum glaucum* cv. PMN Hybrid	Napiergrass hybrid	62
Persea americana	avocado	62
Piper methysticum	‘awa, ‘ava, kava, sakau	62
Plumeria obtusa	plumeria	62
Podocarpus sp.	podocarpus	62
Polygonum minus var. *procerum*	kamole, smartweed	62
Polyscias guilfoylei (syn. *Nothopanax guilfoylei*)	panax, tanitani	62
Portulaca grandiflora	rose-moss	62
Pouteria sandwicensis	‘ala‘a	63
Premna obtusifolia (syn. *Premna serratifolia*)	ahgao, aloalo, topwuk, fienkack, arr, nior, lior, false elder	63
Pritchardia sp.	loulu palm	63
Ptychosperma macarthurii	Macarthur palm	63
Rumex acetosella	sheep sorrel	63
Saccharum hybrid clone *Moentai*	wild cane hybrid	63
Samanea saman (syn. *Albizia saman*)	monkeypod, filinganga, gumorni, tamalini, trong-kon-mames	63
Sapindus saponaria	manele, soapberry	63

Table O. List of Plant Pictures by Scientific Name

Scientific Name	Common Name	Page
Scaevola sericea	naupaka, nanaso	63& 64
Schfflera arboricola	dwarf brassaia	64
Scirpus maritimus var. *paludosus*	makai	64
Scleria sp.		64
Secale cereale	cereal rye	64
Senna guadichaudii	kolomona	64
Sesbania tomentosa	‘ohai	64
Sesbania tomentosa f. *arborea*	‘ohai	64
Setaria verticillata	bristly foxtail	65
Sida fallax	‘ilima	65
Sida fallax	‘ilima papa	65
Sophora chrysophylla	mamane	65
Sorghum bicolor	forage sorghum hybrid	65
Sorghum bicolor x *Sorghum bicolor* var. *sudanese*	sorghum x sudangrass hybrid	65
Sporobolus virginicus	‘aki‘aki, totoput	65
Stenotaphrum secondatum	St. Augustinegrass	65
Stylosanthes scabra cv. Seca	shrubby stylo	65
Styphelia tameiameiae	pukiawe	66
Swietenia macrophylla	mahogany, broad leaved	66
Swietenia mahagoni	mahogany	66
*Syzygium paniculatum (*syn. *Eugenia myrtifolia*)	Australian bush-cherry	66
Tabebuia heterophylla	pink tecoma	66
Tamarindus indica	tamarind	66
Terminalia catappa	false kamani, talie, talisai, miich, tropical almond	66
Thespesia populnea	milo, binalo, banalo, rosewood, badrirt, kilulo, panu, polo, pone, bang-beng	66
Tournefortia argentea	beach heliotrope, hunig, amoloset, chen, kiden, tausuni, techel, titin, sruhsruh	67
Tradescantia spathacea	oyster plant	67
Trifolium repens	white clover	67
Triticum aestivum	wheat	67
Urochloa brizantha (syn. *Brachiaria brizantha*)	signalgrass	67
Urochloa maxima (syn. *Panicum maximum* var. *trichoglume*)	green panicgrass	67
Urochloa maxima (syn. *Panicum maximum*)	guineagrass	67

Table O. List of Plant Pictures by Scientific Name

Table P. List of Plant Pictures by Common Name

Common Name	Scientific Name	Page
‘a‘ali‘i, lampuye	*Dodonaea viscosa*	55
ahgao, aloalo, topwuk, fienkack, arr, nior, lior, false elder	*Premna obtusifolia* (syn*. Premna serratifolia*)	63
‘ahu‘awa, marsh cypress	*Cyperus javanicus*	54
‘akia	*Wikstroemia uva-ursi*	68
‘aki‘aki, totoput	*Sporobolus virginicus*	65
‘ala‘a	*Pouteria sandwicensis*	63
alahe‘e	*Canthium ordoratum* (syn. *Psydrax odorata*)	50
alfalfa	*Medicago sativa*	59
annual ryegrass	*Lolium multiflorum*	59
areca palm	*Chrysalidocarpus letuscens*	51
Australian bush-cherry	*Syzygium paniculatum (syn. Eugenia myrtifolia)*	66
Australian saltbush	*Atriplex semibaccata*	48
avocado	*Persea americana*	62
‘awa, ‘ava, kava, sakau	*Piper methysticum*	62
‘aweoweo	*Chenopodium oahuense*	51
bamboo	*Bambusa* sp.	49
barnyardgrass	*Echinochloa crus-galli*	55
Baron’s grass, paddlegrass reh padil	I*schaemum polystachyum* (syn. *Ischaemum digitatum*)	58
beach heliotrope, hunig	*Tournefortia argentea*	67
beefsteak	*Acalypha wilkensiana*	47
big trefoil	*Lotus pedunculatus*	59
blue vitex, nanulega	*Vitex trifolia* var. *variegata*	68
Bougainvillea, felila	*Bougainvillea spectabilis*	49
breadfruit, ulu, lemai	*Artocarpus altilis*	48
bristly foxtail	*Setaria verticillata*	65
broadleaf carpetgrass	*Axonopus compressus*	49
bromegrass	*Bromus inermis*	49
bromegrass	*Bromus wildenowii*	49
brushbox	*Lophostemon confertus* (syn. Tristania *conferta*)	59
buckwheat	*Fagopyrum esculentum*	56
buffelgrass	*Cenchrus ciliaris* (syn. *Pennisetum ciliare*)	51
cadaga	*Eucalyptus torreliana*	56
California cypress	*Cupressus macrocarpa*	53
callitris	*Callitris* sp.	50

Table P. List of Plant Pictures by Common Name

Common Name	Scientific Name	Page
cape marigold	*Dimorphotheca sinuata*	55
carpet bugle	*Ajuga reptans*	47
centipedegrass	*Eremochloa ophiuroides*	56
cereal rye	*Secale cereale*	64
Chinese fir	*Cunninghamia lanceolata*	53
coconut, niu, lius, iru, lu, ni, niyog, nizok, nu	*Cocos nucifera*	52
colpachi croton	*Croton reflexifolius*	53
common Bermudagrass	*Cynodon dactylon*	53
Cook pine	*Araucaria columnaris*	48
corn	*Zea mays*	68
cowpea	*Vigna unguiculata*	68
croton	*Codium variegatum*	52
day lily	*Hemerocallis aurantiaca*	47
dichondra	*Dichondra repens*	54
digitgrass	*Digitaria eriantha* cv. Pangola	54
digitgrass	*Digitaria eriantha* cv. Transvala	55
dracaena	*Dracaena fragans*	55
Dunn's eucalyptus	*Eucalyptus dunnii*	56
dwarf brassaia	*Schfflera arboricola*	64
dwarf Brazilian banana	*Musa* sp. cv. Santa Catarina Prata	60
dwarf coconut, niu, lius, iru, lu, ni, niyog, nizok, nu	*Cocos nucifera*	52
'emoloa, kawelu, lovegrass	*Eragrostis variabilis*	55
false kamani, talie, talisai, miich, tropical almond	*Terminalia catappa*	66
ferntree	*Filicium decipiens*	57
fishtail palm	*Caryota mitis*	50
forage peanut	*Arachis glabrata*	48
forage peanut	*Arachis pintoi* cv. Amarillo	48
forage sorghum hybrid	*Sorghum* bicolor	65
giant Bermudagrass	*Cynodon dactylon*	53
gliricidia, madre de cacao	*Gliricidia sepium*	57
green panicgrass	*Urochloa maxima* (syn. *Panicum maximum* var. *trichoglume*)	67
guineagrass	*Urochloa maxima* (syn. *Panicum maximum*)	67
hala, ongor, fasa	*Pandanus tectorius*	61
hapu'u, tree fern	*Cibotium menziesii*	51
heen naran (seedy tangerine)	*Citrus lycopersicaeformis*	51
hetero	*Desmodium heterophyllum*	54

Table P. List of Plant Pictures by Common Name

Common Name	Scientific Name	Page
hibiscus, Chinese, aute, flores rosa	*Hibicus rosa-sinensis*	58
Ifit, ifil, ipil, ifilele, dort, choyo, kubok, kuren	*Intsia bijuga*	58
‘ilima	*Sida fallax*	65
‘ilima papa	*Sida fallax*	65
intortum, desmodium	*Desmodium intortum (*or *Desmodium aparines)*	54
ironwood, toa, gagu, laash, ngas, mejinoki, weeku	*Casuarina equisetifolia*	50
Italian cypress	*Cupressus sempervirons*	53
jackfruit	*Artocarpus hetrophyllum*	48
Japanese sugi pine	*Cryptomaria japonica*	53
jobs tears	*Coix lachryma*	52
jungle rice	*Echinochloa colona*	55
kamani, daok, fetau, btaches, biyuch, eet, isou, lueg, rakich	*Calophyllum inophyllum*	50
kamole, smartweed	*Polygonum minus* var. *procerum*	62
koa	*Acacia koa*	47
koai‘a	*Acacia koaia*	47
kolomona	*Senna guadichaudii*	64
kou, niyoron, tauanave, galu, koa, kalau, ikoik, ikoak, anau	*Cordia subcordata*	52
kukui, lama, lumbang, sakan, raguar, candlenut tree	*Aleurites moluccana*	47
lablab	*Lablab purpureus*	58
lemongrass	*Cymbopogon citratus*	53
limpograss	*Hemarthria altissima* cv. Bigalta	57
lippia	*Lippia nodiflora*	59
loulu palm	*Pritchardia* sp.	63
ma‘o, Hawaiian cotton	*Gossypium tomentosum*	57
Macarthur palm	*Ptychosperma macarthurii*	63
mahogany	*Swietenia mahagoni*	66
mahogany, broad leaved	*Swietenia macrophylla*	66
makai	*Scirpus maritimus* var. *paludosus*	64
mamane	*Sophora chrysophylla*	65
manele, soapberry	*Sapindus saponaria*	63
mangium	*Acacia mangium*	47
mango, kangit, idele, mago, mangueira	*Magnifera indica*	59
mau‘u laiki, ricegrass	*Paspalum orbiculare*	61
milo, binalo,banalo, rosewood,	*Thespesia populnea*	66

Table P. List of Plant Pictures by Common Name

Table P. List of Plant Pictures by Common Name

Common Name	Scientific Name	Page
pohuehue, beach morning glory	*Ipomea pes-caprae*	58
Portuguese (Mexican) cypress	*Cupressus lusitanica*	53
poumuli	*Flueggea flexuosa*	57
Puerto Rican stargrass	*Cynodon nlemfuensis* cv. Florico	54
pukiawe	*Styphelia tameiameiae*	66
rainbow shower tree	*Cassia* x *nealii*	50
Rhodesgrass	*Chloris gayana*	51
rice	*Oryza sativa*	60
river-redgum eucalyptus	*Eucalyptus camaldulensis*	56
rose-moss	*Portulaca grandiflora*	62
sea grape	*Coccolba uvifera*	61
seashore paspalum	*Paspalum vaginatum*	61
sheep sorrel	*Rumex acetosella*	63
shell ginger	*Alpinia zerumbet*	47
shrubby stylo	*Stylosanthes scabra* cv. Seca	65
signalgrass	*Urochloa brizantha* (syn. *Brachiaria brizantha*)	67
smallcone ironwood	*Casuarina cunninghamiana*	50
soft rush	*Juncus effusus*	58
sorghum x sudangrass hybrid	*Sorghum bicolor* x *Sorghum bicolor* var.*sudanese*	65
soybean	*Glycine max*	57
spike rush	*Eleocharis geniculata*	55
St. Augustinegrass	*Stenotaphrum secondatum*	65
sunn hemp	*Crotalaria juncea* cv. Tropic Sun	52
swamp mahogany	*Eucalyptus robusta*	56
sweet clover	*Melitotus* sp.	59
tall erythrina	*Erythrina variegata* cv. Tropic Coral	56
tamarind	*Tamarindus indica*	66
three-flower beggarweed	*Desmodium triflorum*	54
ti	*Cordyline fruticosa*	52
‘uhaloa, escobilla sabana, waltheria	*Waltheria indica*	68
‘ulei	*Osteomeles anthyllidifolia*	61
trailing African daisy	*Osteospermum fruticosum*	61
vetch, woolypod	*Vicia villosa* ssp. *varia* cv. Lana	67
vetivergrass	*Chrysopogon zizanioides* (syn. *Vetiveria zizanioides*) cv. Sunshine	51
wheat	*Triticum aestivum*	67
white clover	*Trifolium repens*	67
wild cane hybrid	*Saccharum* hybrid clone *Moentai*	63

Table P. List of Plant Pictures by Common Name

Plant Pictures by Scientific Name

Sources of Pictures and Information:

A Guide to Landscaping and Grounds Maintenance in Hawaii, Guam, and Tropical Pacific Areas by Gerald Swedberg.

A Guide to Pacific Wetland Plants by Lani Stemmermann.

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University of Hawaii Department of Botany Website: http://www.botany.hawaii.edu

USDA Natural Resources Conservation Service

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Acacia koa,
koa

Acacia koaia,
koai‘a

Acacia mangium,
mangium

Acalpha wilkensiana,
beefsteak

Ajuga reptans,
carpet bugle

Aleurites molucana,
kukui, lama, lumbang, sakan, raguar, candlenut tree

Aleurites molucana,
kukui flower, fruit

Alpinia zerumbet,
shell ginger

Alpinia zerumbet,
shell ginger flower

Arachis glabrata, forage peanut

Arachis pintoi cv. Amarillo, forage peanut

Arachis pintoi cv. Amarillo, forage peanut flower

Araucaria columnaris, Cook pine

Araucaria heterophylla, Norfolk Island pine

Artocarpus altilis, breadfruit, ulu, lemai

Artocarpus heterophyllum, jackfruit

Artocarpus heterophyllum, jackfruit fruit

Atriplex semibaccata, Australian saltbush

Avena sativa,
oats

Axonopus affinis,
narrowleaf carpetgrass,
Australian carpetgrass

Axonopus compressus,
broadleaf carpetgrass

Azadirachta indica,
neem

Bambusa sp.,
bamboo

Bougainvillea spectabilis,
Bougainvillea, felila

Bromus inermis,
bromegrass

Bromus wildenowii,
bromegrass

Cajanus cajan,
pigeonpea

Callitris spp.,
callitris

Calophyllum inophyllum,
kamani, daok, fetau, batches, biyuch, eet, isou, lueg, rakich

Calophyllum inophyllum,
kamani flower

Canthium odoratum,
alahe‘e

Canthium odoratum,
alahe‘e flower

Caryota mitis,
fishtail palm

Cassia x *nealii*,
rainbow shower tree

Casuarina cumminghamiana,
smallcone ironwood

Casuarina equisetifolia,
ironwood, toa, gagu, laash, ngas, mejinoki, weeku

Cenchrus ciliaris, buffelgrass

Chenopodium oahuense, ‘aweoweo

Chenopodium oahuense, ‘aweoweo flower

Chloris gayana, Rhodesgrass

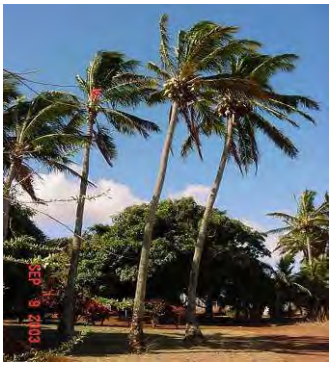
Chrysalidocarpus letuscens, areca palm

Chrysopogon zizanioides cv. Sunshine,vetivergrass

Cibotium manziesii, hapu‘u, tree fern

Citrus lycopersicaeformis, heen naran (seedy tangerine)

Coccoloba uvifera, sea grape



Cocos nucifera, coconut, niu, lius, iru, lu, ni, niyog, nizok, nu

Cocos nucifera, dwarf coconut

Codium variegatum, croton

Coix lachryma, jobs tears

Cordia subcordata, kou, niyoron, tauanave, galu, koa, kalau, ikoik, ikoak, anau

Cordia subcordata, kou flower

Cordyline fruticosa, ti

Crotalaria juncea cv. Tropic Sun, sunn hemp

Crotalaria juncea cv. Tropic Sun, sunn hemp flower

Croton reflexifolius, colpachi croton

Cryptomaria japonica, Japanese sugi pine

Cunninghamia lanceolata, Chinese fir

Cupressus lusitanica, Portuguese (Mexican) cypress

Cupressus macrocarpa, California cypress

Cupressus sempervirons, Italian cypress

Cymbopogon citratus, lemongrass

Cynodon dactylon, common Bermudagrass

Cynodon dactylon, giant Bermudagrass

Cynodon nlemfuensis cv. Florico, Puerto Rican stargrass

Cyperus javanicus, ‘ahu‘awa, marsh cypress

Cyperus polystachyos

Dactylis glomerata, orchardgrass

Desmodium heterophyllum, hetero

Desmodium intortum, intortum, desmodium

Desmodium triflorum, three-flower beggarweed

Dichondra repens, dichondra

Digitaria eriantha cv. Pangola, digitgrass

Digitaria eriantha cv. Transvala, digitgrass

Dimorphotheca sinuata, cape marigold

Dodonaea viscosa, ‘a‘ali‘i, lampuye

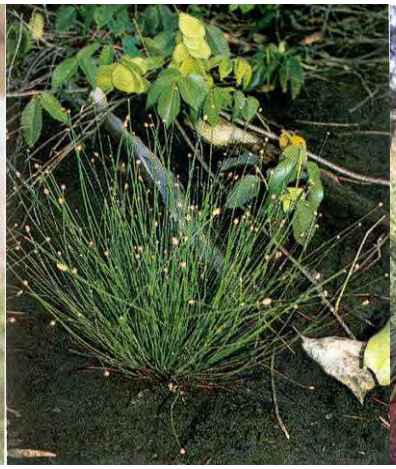
'

Dodonaea viscosa, ‘a‘ali‘i fruit capsule

Dracaena fragrans, dracaena

Echinochloa colona, jungle rice

Echinochloa crus-galli, barnyardgrass



Eleocharis geniculata, spike rush

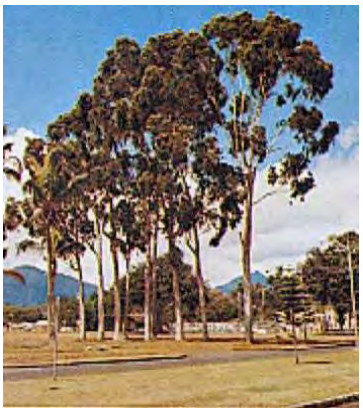
Eragrostis variabilis, ‘emoloa, kawelu, lovegrass

Eremchloa ophiuoides, centipedegrass

Erythrina sandwicensis, wiliwili

Erythrina sandwicensis, wiliwili flower

Erythrina variegata cv. Tropic Coral, tall erythrina



Eucalyptus camaldulensis, river-redgum eucalyptus

Eucalyptus dunnii, Dunn's eucalyptus

Eucalyptus robusta, swamp mahogany

Eucalyptus torreliana, cadaga

Fagopyrum esculentum, buckwheat

Filicium decipiens, ferntree

Fimbrisylis littoralis

Flueggea flexuosa, poumuli

Fragaria chiloensis, ‘ohelo papa

Gliricidia sepium, gliricidia, madra de cacao

Glycine max, soybean

Gossypium tomentosum, ma‘o, Hawaiian cotton

Hemarthria altissima cv. Bigalta, limpograss

Hemerocallis aurantiaca, day lily

Heteropogon contortus, piligrass, tanglehead

Hibiscus arnotianus var. *punaluensis*, Oahu white hibiscus

Hibiscus rosa-sinensis, Chinese hibiscus, aute, flores rosa

Intsia bijuga, ifit, ifil, ipil, ifilele, dort, choyo, kubok, kuren

Ipomea pes-caprae, pohuehue, beach morning glory

Ischaemum polystachyum, Baron's grass, paddlegrass, reh padil

Jacquemontia ovalifolia subsp. *sandwicensis*, pa'uohi'iaka

Juncus effusus, soft rush

Lablab purpureus, lablab

Lippia nodiflora,
lippia

Lolium multiflorum,
annual ryegrass

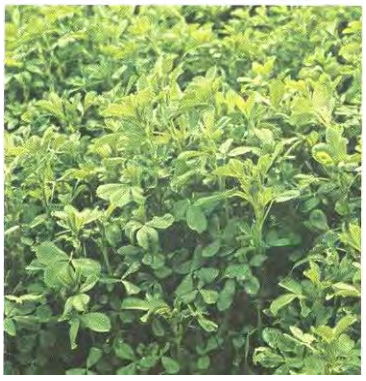
Lolium perenne,
perennial ryegrass

Lophostemon confertus,
brushbox

Lotus pedunculatus,
big trefoil

Lycium sandwicense,
‘ohelo kai

Magnifera indica,
mango, kangit, idele,
mago mangueira



Medicago sativa,
alfalfa

Melilotus sp.,
sweet clover

Metrosideros polymorpha, ‘ohi‘a lehua

Metrosideros polymorpha, ‘ohi‘a lehua flower

Morinda citrifolia, noni, lada, nonu, kesengel, i, nen, mangal’wag, Indian mulberry

Musa sp. cv. Santa Catarina Prata, dwarf Brazilian banana

Myoporum sandwicense, naio

Myoporum sandwicense, naio flower

Nerium oleander, oleander, oliana

Opuntia ficus-indica, panini, prickly pear cactus

Oryza sativa, rice

Osteomeles anthyllidifolia, ‘ulei

Osteomeles anthyllidifolia, ‘ulei flower

Osteospermum fruticosum, trailing African daisy

Pandanus tectorius, Hala, kafu, fasa, ongor

Paspalum hieronymii cv. Tropic Lalo, paspalum

Paspalum orbiculare, mau‘u laiki, ricegrass

Paspalum vaginatum cv. Tropic Shore, seashore paspalum

Pennisetum purpureum cv. Mott, Napiergrass

Pennisetum purpureum x *Pennisetum glaucum* cv. PMN Hybrid, Napiergrass hybrid

Persea americana, avocado

Persea americana, avocado fruit

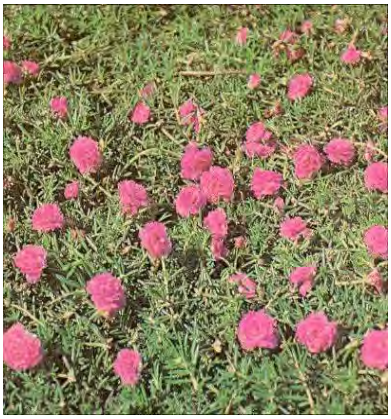
Piper methysticum, ‘awa, `ava, kava, sakau

Plumeria obtusa, plumeria

Podocarpus sp., podocarpus

Polygonum minus var. *procerum*, kamole, smartweed

Polyscias guilfoylei, panax, tanitani



Portulaca grandiflora, rose-moss

Pouteria sandwicensis, ‘ala‘a

Premna obtusifolia, ahgao, aloalo, topwuk, fienkack, arr, nior, lior, false elder

Pritchardia sp., loulu palm

Ptychosperma macarthurii, Macarthur palm

Rumex acetosella, sheep sorrel

Saccharum hybrid clone *Moentai,* wild cane hybrid

Samanea saman, Monkeypod, filinganga, gumorni, tamalini, trong-kon-mames

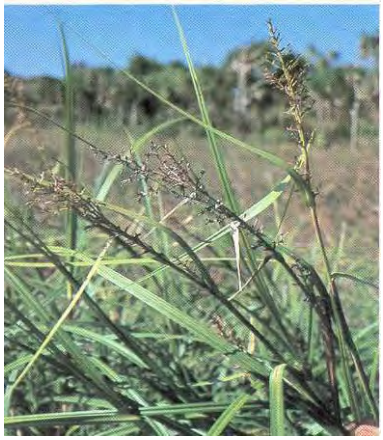
Sapindus saponaria, manele, soapberry

Scaevola sericea, naupaka, nanaso

Scaevola sericea, naupaka flower

Schfflera arboricola, dwarf brassaia

Scirpus maritimus var. *paludosus*, makai



Scleria sp.

Secale cereale, cereal rye

Senna guadichaudii, kolomona

Sesbania tomentosa, ‘ohai

Sesbania tomentosa, ‘ohai flower

Sesbania tomentosa f. *arborea*, ‘ohai

Setaria verticillata,
bristly foxtail

Sida fallax,
‘ilima

Sida fallax,
‘ilima papa

Sophora chrysophylla,
mamane

Sorghum bicolor,
forage sorghum hybrid

Sorghum bicolor x *S. bicolor* var. *sudanese*,
sorghum x sudangrass hybrid

Sporobolus virginicus,
‘aki‘aki, totoput

Stenotaphrum secondatum,
St. Agustinegrass

Stylosanthes scabra
cv. ‘Seca’, shrubby stylo

Stephelia tameiameiae, pukiawe

Swietenia m*acrophylla*, mahogany, broad-leaved

Swietenia mahagoni, mahogany

Syzygium paniculatum, Australian bush-cherry

Tabebuia heterophylla, pink tecoma

Tamarindus indica, tamarind

Terminalia catappa, false kamani, talie, talisai, miich, tropical almond

Thespesia populnea, milo, binalo, banalo, rosewood, badrirt, kilulo, panu, polo, pone, bang-beng

Thespesia populnea, milo flower

Tournefortia argentea, beach heliotrope, hunig, amoloset, chen, kiden, tausuni, techel, titin, sruhsruh

Tradescantia spathacea, oyster plant

Trifolium repens, white clover

Triticum aestivum, wheat

Urochloa brizantha, signalgrass

Urochloa maxima, green panicgrass

Urochloa maxima, guineagrass

Vaccinium reticulatum, ‘ohelo

Vicia villosa ssp. *varia* cv. Lana, vetch, woolypod

Vigna marina, nanea

Vigna unguiculta, cowpea

Vitex rotundifolia, pohinahina, beach vitex

Vitex rotundifolia, pohinahina, beach vitex flower

Vitex trifolia var. *variegata*, blue vitex, nanulega

Waltheria indica, ‘uhaloa, escobilla sabana, waltheria

Wikstroemia uva-ursi, ‘akia

Zea mays, corn

Zoysia japonica, zoysia

PLANT ESTABLISHMENT PROCEDURES

This section of the Pacific Islands Area Vegetative Guide includes generic plant establishment procedures for herbaceous plants and trees and shrubs. There are many species of herbaceous plants and trees and shrubs which are planted for conservation purposes such as to stabilize eroding areas and establish habitat for wildlife. The most common types of herbaceous plants established for conservation purposes include: grasses, sedges, and forbs. Both native and non-native trees and shrubs may be established for conservation purposes. Refer to the Conservation Practice tables in the Vegetative Guide for plant species, planting rates and spacing recommendations. Planners should also refer to individual conservation practice Standards for practice specific and/or additional criteria for plant establishment.

Care in handling and planting the seed, cuttings, seedlings, or vegetative material will ensure an acceptable rate of survival. Only viable, high-quality, and adapted planting material will be used.

HERBACEOUS PLANTS

Types of Planting Material

Herbaceous plants are usually established by planting seeds or by planting vegetative material (stolons, sprigs, or rhizomes).

Certain types of herbaceous plants are also sometimes established by planting dibble tube seedlings or other container-grown stock such as potted seedlings or plants and cell pack seedlings or plugs.

It is somewhat unusual, but possible that bare-root stock (seedlings or plants) and unrooted stem cuttings are used.

Potting bare-root stock 3 to 4 months before planting will help produce more vigorous transplants. If bare-root stock is not planted immediately, it should be “heeled-in” in a V-shaped trench under shade or potted and kept moist.

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.

Site Preparation

Site preparation to clear and prepare the planting site should only be done if required in order to plant the new herbaceous species or for plant establishment. Site preparation is not needed if the planting site is already clear of vegetation and no tillage is needed or the new herbaceous species can be planted in the existing vegetation and successfully established.

Site preparation may include: 1) conventional tillage; 2) conventional tillage and the removal of unwanted plants; or 3) the removal of unwanted plants without tillage (no-till).

Conventional tillage: Conventional tillage site preparation may be used where soil conditions and topography permit the use of equipment, such as tractors. Conventional tillage site preparation usually consists of one primary tillage operation, such as plowing or ripping, followed by disking. Prepare a firm planting bed. If planting large areas of sloping land and no-till is not possible, establish new plantings in increments or in strips alternating with undisturbed areas to minimize erosion. All tillage will be on the contour or cross slope to minimize the erosion hazard, unless topography does not permit it and may cause safety concerns. Treat soil quality concerns, such as tillage pans, to prevent exacerbation of existing problems.

Removal of unwanted plants: Unwanted plants (existing weeds, grasses, trees, and shrubs, etc.) may be mechanically and/or or chemically removed or treated.

Existing weeds and grasses may be removed by mowing and/or spraying with herbicide. Existing trees and shrubs may be pruned back and kept or cut down, dug out or killed with chemicals.

Because of potential seed germination, root suckering or shoot persistence, removal of unwanted plants may need to be repeated two to three times prior to planting the desired species. Allow for a time lapse between each removal activity to ensure adequate control/eradication of unwanted plants.

TREES AND SHRUBS

Types of Planting Material

The most common and preferable planting material for trees and shrubs is dibble tube seedlings or other container-grown stock such as potted seedlings or plants and cell pack seedlings or plugs.

Less common and less preferable is the use of bare-root stock (seedlings or plants) and unrooted stem cuttings.

Potting bare-root stock 3 to 4 months before planting will help produce more vigorous transplants. If bare-root stock is not planted immediately, it should be “heeled-in” in a V-shaped trench under shade or potted and kept moist.

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.

Although less commonly practiced, it is possible to establish certain types of trees and shrubs by directly planting seeds. For example, koa and ‘a’ali’i or lampuye are sometimes direct seeded.

Site Preparation

Site preparation to clear and prepare the planting site should only be done if required in order to plant new trees and shrubs or for plant establishment. Site preparation is not needed if the planting site is already clear of vegetation and no tillage is needed or new trees and shrubs can be planted in the existing vegetation and successfully established. If site preparation is needed, it must be conducted in accordance with the Tree/Shrub Site Preparation (490) practice and the client should consider implementing the 490 practice as part of his/her conservation plan or system.

The practice Tree/Shrub Site Preparation is used to treat areas to improve site conditions for establishing trees and/or shrubs. The purpose of this practice is to encourage natural regeneration of desirable woody plants or to permit artificial establishment of woody plants. Methods of site preparation include: scarification of the land to encourage the natural regeneration of trees and shrubs; mechanical methods such as disking, ripping, chopping, shearing, blading, mowing, or lopping to remove unwanted vegetation or break restrictive soil layers, and chemical (herbicide) application to kill undesirable vegetation.

PLANTING SEEDS

Planting of seeds to establish herbaceous plants or trees and shrubs may be accomplished by broadcasting, drilling, or hydroseeding.

Where seed is broadcast, dragging the area with a chain, light plank, or other suitable implement will help to ensure good soil-seed contact.

Large seeds are generally planted deeper than small seeds. A general recommendation is to plant at a depth equal to four times the diameter of the seed.

Hydroseeded plantings must not be allowed to dry out. Germination and seedling emergence may be low if the mulch/seed mixture is not kept moist.

PLANTING VEGETATIVE MATERIAL (STOLONS, SPRIGS, AND RHIZOMES)

Where Soil Conditions and Topography PERMIT the Use of Equipment

Stolons, sprigs, and rhizomes should be evenly distributed on the prepared ground and disked in. For a more positive placement of the vegetative material, seedbed preparation may be followed by opening furrows at a maximum depth of 6 inches. Vegetative material is then placed in the furrows. Cover the material with soil by disking or other suitable means, leaving some leaves exposed, then compact lightly to ensure good plant-soil contact. A mechanical sprig planter may be used, soil conditions and terrain permitting.

Where Soil Conditions and Topography RESTRICT the Use of Equipment

Dig or open individual planting holes at least 6-inches deep. Sprigs should be inserted at least 5 inches in the hole. The sprigs should have a minimum of two nodes. The hole should then be filled with soil and compacted to ensure good plant-soil contact. Leave at least a 1-inch depression in the hole to trap rainwater and other moisture.

PLANTING OTHER MATERIALS (DIBBLE TUBE, CONTAINER, BAREROOT, AND UN-ROOTED)

Planting

Dibble Tube seedlings: Open a hole and place the seedling in the hole at the same depth as grown in the container. Place moist soil around the seedling and pack. Firm up soil completely around plug.

Container-grown stock such as potted seedling or plants or cell pack seedlings or plugs: Dig a hole at least 50% wider than the container. Root-bound plants should have the root system slit and flared out over a mound of soil in the planting hole. Cut off any long roots before planting. If more than 20% of the root system is cut off, remove (proportionately) the same amount of leaf area. Plant the root ball top at or just below the natural ground level. Refill hole with soil and pack well to remove air-pockets. Prune off diseased or damaged leaves, branches, suckers, etc.

Bare-root stock (seedlings or plants): Open a hole or slit deeper than the root size to be planted to accommodate the root system with all roots pointing down (no “J” or “L” shaped roots). Place the plant slightly deeper than they grew in the nursery (indicated by a change in bark characteristics) with roots naturally positioned. Do not twist or bunch roots. In slit planting, push the plant down to the bottom of the slit, then with a shaking motion, raise it gently back to the correct level. While holding the plant in an upright position, at the correct depth, bring loose, moist soil in around the root system. Do not let dry soil or surface liter into the hole. When the slit or hole is filled, pack the most soil down firmly. No roots should be exposed or foliage covered.

Unrooted cuttings: Open a hole or slit deep enough to allow the cuttings to be inserted so at least ½ to 2/3 of the cutting length is below ground. Insert the cuttings vertically with the buds pointing up, insuring that one to three buds remain above ground. Consider using a rooting hormone to enhance rooting percentage. Firm the soil around the cutting so good contact with the soil is obtained.

OTHER MANAGEMENT ACTIONS TO ENSURE ADEQUATE STAND ESTABLISHMENT

This section includes other generic management actions which may be required to ensure an adequate stand establishment. Each site and planting should be evaluated to determine which actions are required. Some of the same or similar actions may already be included in individual conservation practice Standards and should be followed instead of these.

Care of Plants at Planting Time

Keep seedlings moist at all times. At the field site, store seedlings in the shade or under a reflective space blanket. Do not use canvas to protect seedlings from solar heating. Use a suitable container (bucket, bag, or plastic tray) for carrying the plants during the planting operation. Keep wet material around the roots to prevent their damage through exposure. Never carry a handful of plants exposed to the sun and wind. Take one plant from the container and plant it immediately.

Planting Dates

Planting dates shall be scheduled during approved dates for the species and to optimize soil moisture for germination and/or establishment.

In general, planting in sites without supplemental irrigation should be done as early in the wet season as possible. Avoid planting on hot, windy days.

Planting in sites with supplemental irrigation may be done at any time, provided that adequate moisture is provided immediately after planting.

Supplemental Water for Plant Establishment

Supplemental water via an irrigation system will be applied to establish the plants, if necessary. Irrigation systems must be in place prior to planting. Water immediately after planting, and provide supplemental water for establishment as needed.

Soil Amendments

If needed for stand establishment, apply soil amendments (e.g. lime, fertilizer, compost) according to soil test results. All soil amendment application shall follow the requirements in the Field Office Technical Guide (FOTG) Nutrient Management (590) Standard. Legume seeds should be treated with the correct legume inoculants before planting.

Protection of Plantings

Plantings shall be protected from weeds, insects, diseases, animals or other organisms (including invasive and non-invasive species) as necessary to ensure adequate stand establishment. All pest control shall follow the requirements in the Field Office Technical Guide (FOTG) Pest Management (595) Standard.

Mulching

Mulching around trees or shrubs will help to conserve moisture and control weeds. Organic mulches, cinders and plastic mulches are effective, but local site conditions must be considered. For example, planting seedlings or cuttings through black plastic mulch and irrigating each plant with a drip irrigation system works well for farm windbreak plantings, but may be inappropriate

for wildlife plantings as the plastic may be a hindrance to wildlife or natural regeneration. Consider applying the practice Mulching (484), if appropriate.

OPERATION AND MAINTENANCE

The Operation and Maintenance section of each conservation practice Standard includes required actions to be carried out after establishment that contribute to the longevity and functioning of the conservation practice throughout its expected life.

Actions may include inspections, reseeding or replanting, mowing, fertilization, and pest control or protection. This section may also include requirements for the timing of actions in consideration of wildlife habitat and nesting season and grazing rotations of livestock.