



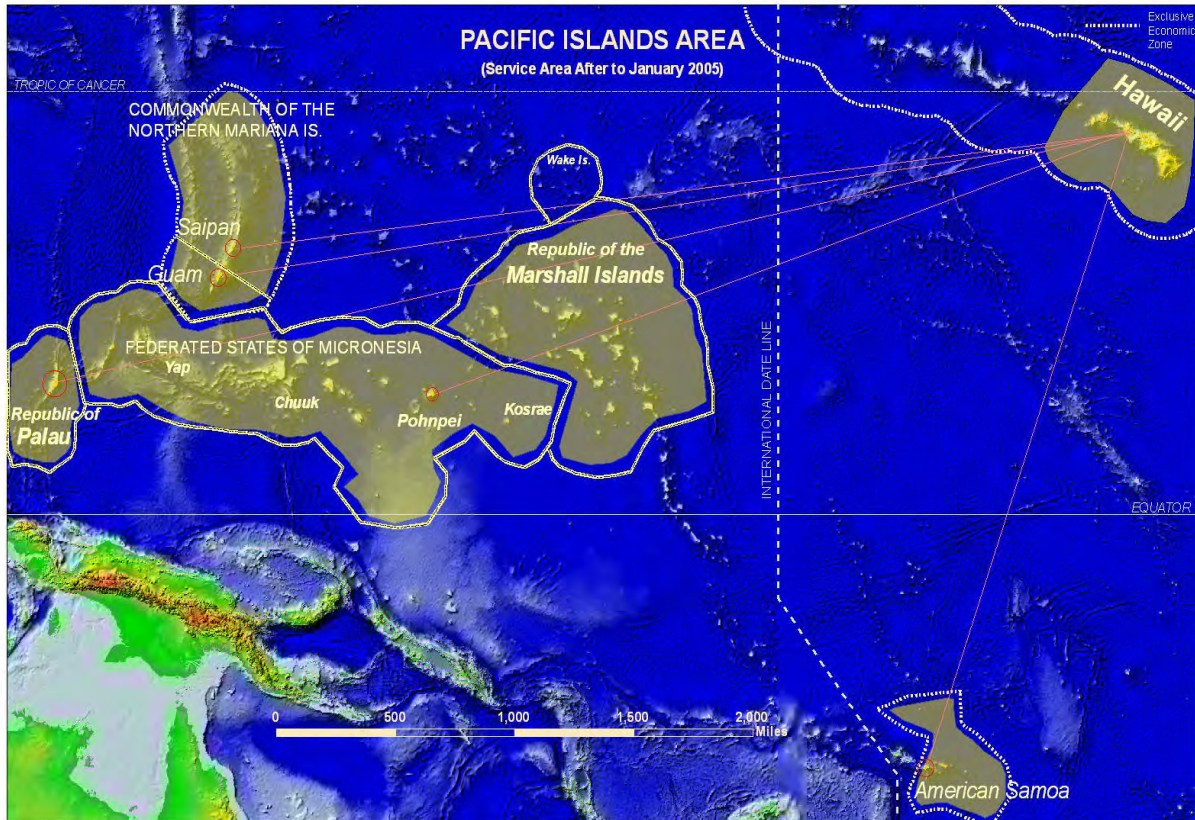
Pacific Islands Area Vegetative Guide

United States Department of Agriculture



Pacific Islands Area

September 2012



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Introduction

The Pacific Islands Area (PIA) Vegetative Guide, September 2012, is a revision of the Pacific Islands Area Vegetative Guide, April 2010, 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 April 2010, generic plant establishment procedures including site preparation and planting for commonly used planting methods was updated in 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, and the selection has been increased because for some practices more than one table can be used. Information on pests for certain species has been added. 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, but not for specific islands. 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 September 2012 revision of the the PIA Vegetative Guide includes the following policy requirements 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. **Native plants are the exception. In the case of natives, planners are only required to obtain the appropriate PIA State-level specialist's approval via email and document the approval in the client's conservation plan. Natives include endemic or indigenous species for a particular island, but exclude species brought in by humans. Some plants may be native to certain islands in the PIA, but not to others. For example, milo or banalo (*Thepesia populnea*) is indigenous to the Mariana Islands, but is not considered to be native to the Hawaiian Islands.**

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* syn. *Cenchrus clandestinus*), 'AZ 1' and 'Whittet' cultivars from the suitable species tables for the following practices: Conservation Cover (327), Critical Area Planting (342), Grassed Waterway (412), Forage and Biomass Planting (512), Range Planting (550), and Recreation Area Improvement (562).

Pacific Islands Area Vegetative Guide

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. **Caution: in Guam ironwood is susceptible to ironwood tree decline disease.** 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.**

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.

Pollinator Habitat

All vegetative conservation practices have had pollinator habitat added to them in some way. NRCS defines pollinator habitat as being for native pollinators and habitat for managed pollinators. Managed pollinators means those kept as “livestock” (usually in hives). The habitat for managed pollinators can be on land that has managed hives on the property or the cooperators rents managed hives for pollination services. In most cases, the habitat for all pollinators should be comprised of at a minimum three different species of flowering native plants suitable for the site. An example of an exception to the native plant requirement is when conservation crop rotation includes pollinator benefits -- nonnative plants can be used since no native plants have been approved for that practice.

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 2)**

Grasses Normally Seeded	Rainfal (inches)	Elevation (feet)	Recommended Seeding Rate (lbs. PLS/ac)
annual ryegrass ^{1/ 6/} (<i>Lolium multiflorum</i>)	40 -150	0 – 7,000	
mixed w/ other grasses			10
annual ryegrass alone			20
Bermudagrass ^{4/ 5/ 6/} (<i>Cynodon dactylon</i>)	20 – 100 (-170)	0 – 3,000	6
'emoloo, kawelu ^{3/} (<i>Eragrostis variabilis</i>)	20 - 80	0 – 3,500	6
green panicgrass ^{4/ 6/} (<i>Urochloa maxima</i>)	25 - 70	0 – 2,500	6
'Petrie'			
narrowleaf carpetgrass ^{8/ 6/} (<i>Axonopus fissifolius</i>)	40 – 80 (-160)	0 – 5,000	40
oats ^{1/} (<i>Avena sativa</i>)	40 - 150	0 – 7,000	
Mixed w/ other grasses			35
oats alone			70
orchardgrass (<i>Dactylis glomerata</i>)	40 - 100	3,000 – 7,000	12
perennial ryegrass (<i>Lolium perenne</i>)	40 - 100	1,500 – 7,000	24
'Tetraploid'			
piligrass, tanglehead ^{3/ 7/} (<i>Heteropogon contortus</i>)	15 – 45 (-90)	0 – 2,000	6
Rhodesgrass ^{5/} (<i>Chloris gayana</i>) 'Bell', 'Katambora', 'Nemkat' ^{4/}	25 - 45	0 – 3,000	6
signalgrass ^{5/} (<i>Urochloa brizantha</i>)	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/} (<i>Ischaemum polystachyum</i>)	50 - 200	0 – 3,000	40
broadleaf carpetgrass ^{8/ 6/} (<i>Axonopus compressus</i>)	40 – 160 (-200)	0 - 5000	40
digitgrass ^{4/ 5/} (<i>Digitaria eriantha</i>)	50 -160	0 – 3,500	40
'Mealani'			
'Pangola'			
paspalum (<i>Paspalum hieronymi</i>)	50 - 150	0 – 3,000	40
'Tropic Lalo'			
St. Augustinegrass ^{6/} (<i>Stenotaphrum secundatum</i>) "dwarf"	40 - 80	0 – 3,000	40
zoysiagrass (<i>Zoysia japonica</i>) 'El Toro'	40 -100	0 – 4,000	40

**Table A. Conservation Cover (327)
Suitable Species (Page 2 of 2)**

Legumes	Rainfall (inches)	Elevation (feet)	Recommended Seeding Rate
big trefoil (<i>Lotus pedunculatus</i>) 'Grasslands Maku'	50 -100	1,500 – 6,000	10
forage peanut (<i>Arachis pintoii</i>) 'Amarillo', 'Forrajero'	50 +	0 – 3,000	20
hetero ^{6/} (<i>Desmodium heterophyllum</i>)	60 - 160	0 – 2,500	10
intortum, desmodium (<i>Desmodium intortum</i>) 'Greenleaf', 'Kuiaha'	60 - 120	0 – 3,000	10
Spanish clover, kaimi clover, latti pako ^{6/} ^{8/} (<i>Desmodium incanum</i>)	(40-) 60 - 120	0 -3,000	10
three-flowered beggarweed ^{6/} (<i>Desmodium triflorum</i>)	60 - 160	0 – 2,500	10
white clover (<i>Trifolium repens</i>) '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 (except for natives). Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

- ^{1/} Use annuals for rapid, temporary cover either mixed with other species or prior to planting the permanent cover.
- ^{2/} A bushel equals 1.25 cubic feet.
- ^{3/} Native.
- ^{4/} Resistant to root-knot nematodes.
- ^{5/} Tolerant of soil salinity and wind-borne salt
- ^{6/} Potentially invasive species (see "Introduction" pages 1 and 2). 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 (<i>Medicago sativa</i>) 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/} (<i>Melilotus alba</i> , <i>M. officinalis</i>) cv. Hubam	20	6.0 – 8.0	Clover	90	2.5	63	0	Year round 0 – 3,000'
clover, white (<i>Trifolium repens</i>) cv. Haifa, NZ	10	5.5 – 7.0	Clover	90	1.0	85	0	Year round 1,500' – 7,000'
cowpea (<i>Vigna unguiculata</i>) 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/} (<i>lablab purpureus</i>) cv. Rongai	60	4.5 – 6.5	Lablab specific	60	2.5	50	0	Year round 0 – 4,000'
mung bean (<i>Vigna radiata</i>)	80	5.4 – 8.3	Cowpea	60	1.5	60	0	Year round 0 – 1,000' spring/summer 0 – 2,500'
pigeonpea ^{1/} (<i>Cajanus cajan</i>)	40 – 60 ^{3/}	5.0 – 8.3	Cowpea	90	2.5	50	0	Year round 0 – 3,000'
soybean (<i>Glycine max</i>)	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/} (<i>Crotalaria juncea</i>) 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/} (<i>Vicia sativa</i>)	60	4.5 – 6.5	Pea/vetch	90	1.5	60	0	Year round 1,500' – 4,000'
vetch, purple ^{4/} (<i>Vicia benghalensis</i>)	50	4.5 – 6.5	Pea/vetch	90	1.5	73	0	Year round 1,500' – 4,000'
vetch, woolypod ^{4/ 5/} (<i>Vicia villosa</i> ssp. <i>varia</i>) 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/} (<i>Lolium multiflorum</i>) ^{7/}	40	5.5 – 7.0		90	1	13	25	Year round 0 – 7,000'
barley ^{5/ 6/} (<i>Hordeum vulgare</i>)	70	5.0 – 8.3		90	1	18	20	Year round 0 – 4,000'
buckwheat ^{4/ 5/} (<i>Fagopyrum esculentum</i>) cv. Japanese, common	60	4.5 – 6.5		30	1.5	18	20	Year round 0 – 4,000'
millet, pearl millet (<i>Pennisetum glaucum</i>)	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 (<i>Avena strigosa</i>) cv. Soilsaver ^{1/5/}	70	5.5 – 7.0		60	1.5	16	20	Year round 0 – 7,000'
oats, common ^{5/} (<i>Avena sativa</i>) 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 (<i>Avena bysantina</i>)	70	5.5 – 7.0		60	1.5	16	20	Year round 0 – 7,000'
rye, cereal ^{5/ 6/} (<i>Secale cereale</i>) cv. Danko, Elbon	70	5.5 – 7.0		90	1.5	18	20	Year round 0 – 7,000'
sorghum x sudangrass (<i>Sorghum</i> hybrids) ^{1/ 5/} sorghum, forage (<i>Sorghum bicolor</i>)	50	5.5 – 8.3		60	3	13	25	Year round 0 – 1,000' spring/summer 0 – 2,500'
sudangrass (<i>Sorghum bicolor</i> ssp. <i>drummondii</i>) ^{1/ 7/}	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/} (<i>Triticum aestivum</i>)	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 and with concurrence from the PIA Plant Materials Specialist (except for natives).

Planners are also required to document the approval/concurrence in the client’s conservation plan. See “Introduction” on pages 1 and 2.

^{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” on pages 1 and 2). 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, totopot, ^{4/ 8/}	<i>Sporobolus virginicus</i>	0 - 1,000	20+	^{3/}
annual ryegrass ^{5/ 10/}	<i>Lolium multiflorum</i>	0 - 7,000	40 - 150	40
Australian saltbush ^{8/} 'Corto'	<i>Atriplex semibaccata</i>	0 - 6,000	20 - 30	20
barley ^{5/ 8/}	<i>Hordeum vulgare</i>	0 - 4,000	40+	70
Baron's grass, paddlegrass, reh padil ^{4/ 9/ 10/}	<i>Ischemum polystachyum</i>	0 - 3,000	50 - 200	^{3/}
Bermudagrass ^{7/ 8/ 10/}	<i>Cynodon dactylon</i>	0 - 3,000	20 - 100 (-170)	35 ^{3/}
common				
'NK-37'(giant)				
buckwheat ^{5/}	<i>Fagopyrum esculentum</i>	0 - 4,000	40+	60
centipedegrass	<i>Eremochloa ophiuroides</i>	0 - 2,500	40+	20 ^{3/}
digitgrass ^{7/ 9/} 'Mealani' 'Pangola' 'Transvala'	<i>Digitaria eriantha</i>	0 - 3,500	50 - 160	^{3/}
'emoloa, kawelu ^{4/}	<i>Eragrostis variabilis</i>	0 - 3,500	20 - 80	10
green panicgrass ^{7/ 10/} 'Petrie'	<i>Urochloa maxima</i>	0 - 2,500	25 - 70	20
hairy chess Napiergrass 'Mott'	<i>Bromus catharticus</i> <i>Pennisetum purpureum</i>	3,000 - 7,000 0 - 3,000	40 - 100 40+	20 ^{3/}
narrowleaf carpetgrass ^{9/ 10/}	<i>Axonopus fissifolius</i>	0 - 5,000	50 - 80 (-160)	40 ^{3/}
oats ^{5/}	<i>Avena sativa</i>	0 - 7,000	40 - 150	70
orchardgrass	<i>Dactylis glomerata</i>	3,000 - 7,000	40 - 100	20
paspalum 'Tropic Lalo'	<i>Paspalum hieronymi</i>	0 - 3,000	50 - 150	^{3/}
perennial ryegrass	<i>Lolium perenne</i>	1,500 - 7,000	40 - 100	40
piligrass ^{4/}	<i>Heteropogon contortus</i>	0 - 2,000	15 - 45 (-90)	10
Rhodesgrass ^{8/} 'Bell' 'Katambora' 'Nemkat' ^{7/}	<i>Chloris gayana</i>	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'	<i>Paspalum vaginatum</i>	0 - 1,000	40 - 200	^{3/}
stargrass, Puerto Rican ^{8/} 'Florico'	<i>Cynodon nlemfuensis</i>	0 - 3,000	20 - 80	^{3/}
stargrass, South Point ^{8/}	<i>Cynodon plectostachyus</i>	0 - 3,000	20 - 80	^{3/}
St. Augustinegrass ^{8/} ^{10/}	<i>Stenotaphrum secundatum</i>	0 - 3,000	40 - 80	^{3/}
vetivergrass ^{7/} 'Sunshine'	<i>Chrysopogon zizanioides</i>	0 - 3,000	35 - 200	^{3/}
wheat ^{5/ 8/}	<i>Triticum aestivum</i>	0 - 4,000	40+	70
Legumes				
big trefoil 'Grasslands Maku'	<i>Lotus pedunculatus</i>	1,500 - 6,000	50 - 100	20
forage peanut ^{7/}	<i>Arachis glabrata</i>	0 - 3,000	50+	^{3/}
forage peanut 'Amarillo' 'Forrajero'	<i>Arachis pintoi</i>	0 - 3,000	50+	40 ^{3/}
hetero ^{9/}	<i>Desmodium heterophyllum</i>	0 - 2,500	60 - 160	20 ^{3/}
intortum, desmodium 'Greenleaf' 'Kuiaha'	<i>Desmodium intortum</i>	0 - 3,000	60 - 120	20
lablab, dolichos 'Rongai'	<i>Lablab purpureus</i>	0 - 4,000	20 - 120	60
nanea, fue sina, beach vigna ^{4/}	<i>Vigna marina</i>	0 - 1,000	20+	20 ^{3/}
shrubby stylo, 'Seca'	<i>Stylosanthes scabra</i>	0 - 3,000	25 - 80	20
Spanish clover, kaimi clover, lattil pako ^{9/ 10/}	<i>Desmodium incanum</i>	0 - 3,000	(40-) 60 - 120	20
sunn hemp ^{5/ 6/ 7/} 'Tropic Sun'	<i>Crotalaria juncea</i>	0 - 2,500	20+	40
three-flowered ^{9/} beggarweed	<i>Desmodium triflorum</i>	0 - 2,500	60 - 160	^{3/}
white clover 'Grasslands Huia' (New Zealand) 'Haifa'	<i>Trifolium repens</i>	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 (Herbaceous and Woody)				
'akia ^{4/}	<i>Wikstroemia uva-ursi</i>	0 - 1,000	20+	^{3/}
cape marigold	<i>Dimorphotheca sinuata</i>	0 - 3,000	20+	^{3/}
carpet bugle	<i>Ajuga reptans</i>	0 - 3,000	30+	^{3/}
day lily	<i>Hemerocallis aurantiaca</i>	0 - 4,000	30+	^{3/}
dichondra	<i>Dichondra repens</i>	0 - 4,000	30+	^{3/}
'ilie'e ^{4/}	<i>Plumbago zeylanica</i>	0 - 2,000	30+	^{3/}
'ilima & 'ilima papa ^{4/} (flat ilima)	<i>Sida fallax</i>	0 - 6,000	15+	^{3/}
joyweed	<i>Alternanthera tenella</i>	0 - 3,000	40+	^{3/}
lippia ^{8/}	<i>Lippia nodiflora</i>	0 - 2,500	40+	^{3/}
'ohai ^{8/}	<i>Sesbania tomentosa</i>	0 - 2,500	20 - 40	^{3/}
'ohelo papa ^{4/} (wild strawberry)	<i>Fragaria chiloensis</i>	0 - 6,000	40+	^{3/}
pa'uohi'iaka ^{4/ 8/}	<i>Jacquemontia ovalifolia</i>	0 - 1,000	20 - 45	^{3/}
pohinahina, beach vitex ^{4/ 8/}	<i>Vitex rotundifolia</i>	0 - 1,000	20+	^{3/}
pohuehue, beach morning glory) ^{4/ 8/}	<i>Ipomoea pes-caprae</i>	0 - 1,000	20+	^{3/}
portulaca, moss rose ^{8/}	<i>Portulaca grandiflora</i>	0 - 4,000	20+	^{3/}
trailing African daisy	<i>Osteospermum fruticosum</i>	0 - 4,000	40+	^{3/}
'uhaloa, escobilla sabana ^{4/}	<i>Waltheria Indica</i>	0 - 3,500	15+	^{3/}
Waipahu fig	<i>Ficus tikuoa</i>	0 - 2,000	40+	^{3/}
Common Name / Cultivar	Scientific Name	Elevation (ft.)	Rainfall (in.) ^{1/}	Spacing (ft.)
Woody Plants				
'a'ali'i, lampuye ^{4/}	<i>Dodonaea viscosa</i>	0 - 7,000	20+	10 x 10
alaha'e ^{4/}	<i>Psydrax odorata</i>	0 - 3,000	40+	10 x 10
'aweoweo ^{4/}	<i>Chenopodium oahuense</i>	0 - 6,000	20+	6 x 6
bamboo, clumping	<i>Bambusa</i> spp.	0 - 3,000	60+	6 x 6
Bermuda juniper	<i>Juniperus bermudiana</i>	0 - 3,500	40+	10 x 10
blue vitex, nanulega ^{8/}	<i>Vitex trifolia</i> var. <i>variegata</i>	0 - 4,000	30+	4 x 4
Bougainvillea, felila ^{8/}	<i>Bougainvillea spectabilis</i>	0 - 2,500	25+	10 x 10
Cook pine ^{8/}	<i>Araucaria columnaris</i>	0 - 3,000	40+	15 x 15
dracaena	<i>Dracaena fragrans</i>	0 - 2,000	50+	6 x 6
dracaena	<i>Dracaena dermensis</i>	0 - 2,000	50+	6 x 6
eucalyptus	<i>Eucalyptus</i> spp.	0 - 6,000	30+	10 x 10
gliricidia ^{6/ 9/}	<i>Gliricidia sepium</i>	0 - 3,000	25+	6 x 6
hala, kafu, fasa, ongor, ^{4/ 8/ 9/}	<i>Pandanus tectorius</i>	0 - 500	40+	15 x 15
hibiscus, Chinese, aute, flores rosa	<i>Hibiscus rosa-sinensis</i>	0 - 3,000	30+	6 x 6
hibiscus, Hawaiian white ^{4/}	<i>Hibiscus</i> spp.	0 - 3,000	30+	6 x 6
ironwood, toa, gagu ^{6/ 8/ 11/}	<i>Casuarina equisetifolia</i>	0 - 2,500	30+	10 x 10
kamani, daok, fetau ^{4/ 8/}	<i>Calophyllum inophyllum</i>	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/}	<i>Acacia koa</i>	200 – 6,500	35+	15 x 15
koai'a ^{4/ 6/}	<i>Acacia koaia</i>	200 – 6,500	35+	10 x 10
kou, niyoron ^{4/ 8/}	<i>Cordia subcordata</i>	0 – 500	30+	10 x 10
kukui, lama, sakan, candlenut tree ^{10/}	<i>Aleurites moluccana</i>	0 – 2,000	50+	10 x 10
'kulu'i ^{4/}	<i>Nototrichium sandwicense</i>	0 – 6,000	20+	6 x 6
mamane ^{4/ 6/}	<i>Sophora chrysophylla</i>	1,500 – 8,000	30+	10 x 10
maneie, soapberry ^{4/}	<i>Sapindus saponaria</i>	0 – 4,000	50+	15 x 15
ma'o, Hawaiian cotton ^{4/}	<i>Gossypium tomentosum</i>	0 – 1,000	20+	4 x 4
milo, banalo, rosewood, badrirt, pone ^{4/ 8/ 10/}	<i>Thespesia populnea</i>	0 – 500	20+	10 x 10
naio ^{4/ 8/}	<i>Myoporum sandwicense</i>	0 – 7,500	30+	10 x 10
naupaka, nanaso ^{4/ 8/}	<i>Scaevola sericea</i>	0 – 500	30+	6 x 6
noni, lada, nonu, Indian mulberry, kesengel ^{8/ 10/}	<i>Morinda citrifolia</i>	0 – 1,500	30+	10 x 10
Norfolk Island pine ^{8/}	<i>Araucaria heterophylla</i>	0 – 3,000	30+	15 x 15
'ohai ^{4/ 6/ 8/}	<i>Sesbania tomentosa</i> f. <i>arborea</i>	0 – 2,500	20 - 40	6 x 6
'ohi'a lehua ^{4/}	<i>Metrosideros polymorpha</i>	0 – 8,000	60+	10 x 10
pago, fau, hau, ermall, kalau, lo, gaal, kilife ^{4/}	<i>Hibiscus tiliaceus</i>	0 - 500	30+	10 x 10
small cone ironwood ^{6/ 10/}	<i>Casuarina cunninghamiana</i>	0 – 3,000	30+	10 x 10
ti	<i>Cordyline fruticosa</i>	0 – 6,000	30+	4 x 4
'ulei ^{4/ 8/}	<i>Osteomeles anthyllidifolia</i>	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 (except for natives). Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

^{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. **Note: koa and koai'a are susceptible to koa wilt at low elevations (below approximately 2,000 feet).**

^{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 prior to planting the permanent cover.

^{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" on pages 1 and 2). 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 of ironwood is approved for planting because it is native. **Caution: in Guam it is susceptible to a dieback disease.** 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/ 4/}	<i>Cynodon dactylon</i>	0 – 3,000	20 – 100 (-170)	35 lbs/PLS/ac ^{5/}
carpetgrass ^{1/ 4/}	<i>Axonopus fissifolius</i>	0 – 5,000	40 – 80 (-160)	40 lbs/PLS/ac
centipedegrass	<i>Eremochloa ophiuroides</i>	0 – 2,500	40+	20 lbs/PLS/ac
digitgrass ^{2/}	<i>Digitaria eriantha</i> , 'Pangola', 'Transvala'	0 – 3,500	50 – 160	80 bu/ac ^{6/}
paspalum	<i>Paspalum hieronymi</i> , 'Tropic Lalo'	0 – 3,000	50 – 150	80 bu/ac
St. Augustinegrass ^{3/ 4/}	<i>Stenotaphrum secundatum</i>	0 – 3,000	40 – 80	80 bu/ac
zoysiagrass	<i>Zoysia japonica</i> , '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 (except for natives). Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

* 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" on pages 1 and 2). 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 ^{3/}	<i>Pennisetum purpureum</i>	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 crops. An up-right, tall strain of Napiergrass. Requires trimming on lee side to remain compact.
'Mott' dwarf elephantgrass	<i>Pennisetum purpureum</i>	0 – 3,000	40+	(6-12) X (12-24)	canes--one node overlap Minimum of 2 internodes per cane.	Will not volunteer. Requires trimming on lee side.
Napier x pearl millet hybrid	<i>Pennisetum purpureum</i> x <i>Pennisetum glaucum</i>	0 – 3,000	40+	(6-12) X (12-24)	canes--one node overlap Minimum of 2 internodes per cane.	Sterile seeds. Will not volunteer. Requires trimming on lee side.
wild cane hybrid	<i>Saccharum</i> hybrid clone <i>Moentai</i>	0 – 3,000	35+	(6-12) X (12-24)	canes--one node overlap Minimum of 2 internodes per cane.	Sterile seeds. Will not volunteer. Requires trimming on lee side. Irrigating minimum amount for effective wind barrier reduces maintenance.
Annuals Effective Height 6 - 8 feet						
corn	<i>Zea mays</i>	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	<i>Sorghum bicolor</i>					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/}	<i>Sorghum bicolor</i> x <i>S. bicolor</i> var. <i>sudanese</i>					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.
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.
'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 (except for natives). Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

^{1/} May require irrigation for establishment and during dry season.

^{2/} Resistant to root-knot nematodes.

^{3/} Potentially invasive species (see "Introduction" page 1 and 2). In order to include potentially invasive species 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.

**Table F. Forage and Biomass 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 (<i>Medicago sativa</i>) 'CUF-101', 'Moapa 69' ^{8/} , 'WL-605', 'WL-656', 'WL-711WF' ^{8/ 11/}	50 - 100+	0 - 4,000	20
Bermudagrass ^{8/ 9/ 10/} : 'NK-37' (giant) (<i>Cynodon dactylon</i>)	20 - 100 (-170)	0 - 3,000	5
buffelgrass ^{8/} : 'T-4464', 'Gayndah' (<i>Cenchrus ciliaris</i>)	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/} (<i>Eragrostis variabilis</i>)	20 - 80	0 - 3,500	5
green panicgrass ^{8/ 10/} : 'Petrie' (<i>Urochloa maxima</i>)	25 - 70	0 - 2,500	5
guineagrass ^{10/} : 'Natsukazi' (<i>Urochloa maxima</i>)	35 - 100+	0 - 2,500	5
orchardgrass (<i>Dactylis glomerata</i>)	40 - 100	3,000 - 7,000	10
perennial ryegrass: 'Linn', 'Tetraploid' (<i>Lolium perenne</i>)	40 - 100	1,500 - 7,000	20
piligrass ^{3/} (<i>Heteropogon contortus</i>)	15 - 45 (-90)	0 - 2,000	5
Rhodesgrass ^{9/} : 'Bell', 'Katambora', 'Nemkat' ^{8/} (<i>Chloris gayana</i>)	25 - 45	0 - 3,000	5
signalgrass ^{9/} : 'Basilick', 'Mulato', 'Mulato II' (<i>Urochloa brizantha</i>) (<i>Urochloa</i> spp. hybrids)	50 - 120	0 - 3,000	8
Legumes/Cultivars^{4/}			
big trefoil: 'Grasslands Maku' (<i>Lotus pedunculatus</i>)	50 - 100	1,500 - 6,000	5
Intortum, desmodium: 'Greenleaf', 'Kuiaha' (<i>Desmodium intortum</i>)	60 - 120	0 - 3,000	5
KX2 leucaena hybrid (<i>Leucaena leucocephala</i> subsp. <i>glabrata</i>)	30 - 100	0 - 2,500	5
shrubby stylo ^{14/} : 'Seca'	25 - 80	0 - 3,000	5
Spanish clover, kaimi clover, lattil pako ^{10/ 14/} (<i>Desmodium incanum</i>)	(40-) 60 - 120	0 - 3,000	5
white clover ^{5/} : 'Haifa', 'Grasslands Huia' (NZ) (<i>Trifolium repens</i>)	35 - 80	1,500 - 7,000	5

**Table F. Forage and Biomass 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/} (<i>Ischaemum polystachyum</i>)	50 - 200	0 - 3,000	*
digitgrass ^{8/ 14/} : 'Mealani', 'Pangola' (<i>Digitaria eriantha</i>)	50 - 160	0 - 3,500	*
limpograss ^{15/} : 'Bigalta' (<i>Hemarthria altissima</i>)	60+	0 - 4,000	*
Napiergrass, elephantgrass: 'Mott' ^{7/} (<i>Pennisetum purpurem</i>)	40+	0 - 3,000	*
stargrass, Puerto Rican ^{9/} : 'Florico' (<i>Cynodon nlemfuensis</i>)	20 - 80	0 - 3,000	*
stargrass, South Point ^{9/} (<i>Cynodon plectostachyus</i>)	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 (except for natives). Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

* 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 and 2). 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' (<i>Cenchrus ciliaris</i>)	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/} (<i>Eragrostis variabilis</i>)	15 - 80	0 - 3,500	2
giant bermudagrass ^{7/ 8/ 9/} : 'NK-37' (<i>Cynodon dactylon</i>)	20 - 100 (-170)	0 - 3,000	2
green panicgrass ^{7/ 9/} : 'Petrie' (<i>Urochloa maxima</i>)	25 - 70	0 - 2,500	2
guineagrass ^{9/} : 'Natsukazi' (<i>Urochloa maxima</i>)	35 - 100+	0 - 2,500	2
orchardgrass (<i>Dactylis glomerata</i>)	40 - 100	3,000 - 7,000	4
perennial ryegrass: 'Linn', 'Tetraploid' (<i>Lolium perenne</i>)	40 - 100	1,500 - 7,000	5
piligrass ^{3/} (<i>Heteropogon contortus</i>)	15 - 45 (-90)	0 - 2,000	2
Rhodesgrass ^{8/} : 'Bell', 'Katambora', 'Nemkat' ^{7/} (<i>Chloris gayana</i>)	25 - 45	0 - 3,000	2
signalgrass ^{8/} : 'Basilick', 'Mulato', 'Mulato II' (<i>Urochloa brizantha</i>) (<i>Urochloa</i> spp. hybrids)	50 - 120	0 - 3,000	3
Legumes/Cultivars ^{4/}			
big trefoil: 'Grasslands Maku' (<i>Lotus pedunculatus</i>)	50 - 100	1,500 - 6,000	2
intortum, desmodium: 'Greenleaf', 'Kuiaha' (<i>Desmodium intortum</i>)	60 - 120	0 - 3,000	2
shrubby stylo ^{12/} : 'Seca'	25 - 80	0 - 3,000	2
Spanish clover, kaimi clover, latti pako ^{9/ 12/} (<i>Desmodium incanum</i>)	(40-) 60 - 120	0 - 3,000	2
white clover ^{5/} : 'Haifa', 'Grasslands Huia' (NZ) (<i>Trifolium repens</i>)	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/} (<i>Ischaemum polystachyum</i>)	50 - 200	0 - 3,000	*
digitgrass ^{7/ 12/} : 'Mealani', 'Pangola' (<i>Digitaria eriantha</i>)	50 - 160	0 - 3,500	*
limpograss ^{13/} : 'Bigalta' (<i>Hemarthria altissima</i>)	60+	0 - 4,000	*
Napiergrass: 'Mott' (<i>Pennisetum purpureum</i>)	40+	0 - 3,000	*
stargrass, Puerto Rican ^{8/} : 'Florico' (<i>Cynodon nlemfuensis</i>)	20 - 80	0 - 3,000	*
stargrass, South Point ^{8/} (<i>Cynodon plectostachyus</i>)	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 (except for natives). Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

* 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" on pages 1 and 2). 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, totopot ^{3/ 4/} (<i>Sporobolus virginicus</i>)		X	X		X
Bermudagrass ^{1/ 2/ 4/} (<i>Cynodon dactylon</i>)		X	X	X	
centipedegrass (<i>Eremochloa ophiuroides</i>)	X		X		
'emoloa, kawelu ^{5/} (<i>Eragrostis variabilis</i>)					X
paspalum 'Tropic Lalo' (<i>Paspalum hieronymii</i>)			X	X	
piligrass, tanglehead ^{3/} (<i>Heteropogon contortus</i>)					X
Rhodesgrass ^{4/} 'Bell', 'Katambora', 'Nemkat' ^{1/} (<i>Chloris gayana</i>)					X
seashore paspalum ^{2/ 4/} 'Tropic Shore' (<i>Paspalum vaginatum</i>)		X	X		X
St. Augustinegrass ^{2/ 4/} (<i>Stenotaphrum secundatum</i>)	X	X	X		
zoysiagrass ^{4/} 'El Toro' (<i>Zoysia japonica</i>)	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. See "Introduction" on pages 1 and 2.

^{1/} Resistant to root-knot nematodes.

^{2/} Potentially invasive species (see "Introduction" on pages 1 and 2). 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.

^{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/}	<i>Dodonaea viscosa</i>	X	X		X	X
'akia ^{2/}	<i>Wikstromia uva-ursi</i>	X	X			
alahe'e ^{2/}	<i>Psydrax odorata</i>	X	X		X	X
areca palm	<i>Chrysalidocarpus lutescens</i>	X			X	X
Bougainvillea ^{1/}	<i>Bougainvillea spectabilis</i>	X	X		X	
breadfruit, ulu ^{2/}	<i>Artocarpus communis</i>	X		X		X
Cook pine ^{1/}	<i>Araucara columnaris</i>	X				X
croton	<i>Codium variegatum</i>	X			X	X
eucalyptus	<i>Eucalyptus</i> spp.	X		X		X
false kamani, talie ^{2/}	<i>Terminalia catappa</i>	X		X		X
hala, ongor, fasa ^{1/ 2/}	<i>Pandanus tectorius</i>	X		X		X
hibiscus, aute ^{2/}	<i>Hibiscus</i> spp.	X			X	X
Ipil, ifilele, ifit, dort ^{2/}	<i>Intsia bijuga</i>	X		X		X
kamani, daok ^{1/ 2/}	<i>Calophyllum inophyllum</i>	X		X		X
koa ^{2/}	<i>Acacia koa</i>			X		X
koai'a ^{2/}	<i>Acacia koaia</i>		X	X		X
kou, niyoron ^{1/ 2/}	<i>Cordia subcordata</i>	X	X	X		X
kukui, lama ^{3/}	<i>Aleurites moluccana</i>	X		X		X
loulou palm ^{2/}	<i>Pritchardia</i> spp.	X	X			X
maneie, soapberry ^{2/}	<i>Sapindus saponaria</i>			X		X
ma'o ^{2/}	<i>Gossypium sandwicense</i>	X	X			
milo, banalo ^{1/ 2/ 3/}	<i>Thepesia populnea</i>	X	X	X		X
monkeypod	<i>Samanea saman</i>	X		X		
naio ^{1/ 2/}	<i>Myoporum sandwicense</i>	X	X		X	X
naupaka, nanaso ^{1/ 2/}	<i>Scaevola sericea</i>	X	X		X	X
'ohi'a lehua ^{2/}	<i>Metrosideros polymorpha</i>	X		X		X
pink tecoma, trumpet	<i>Tabebuia</i> spp.	X		X		X
plumeria	<i>Plumeria</i> spp.	X		X		
shower tree	<i>Cassia</i> spp.	X		X		X
ti	<i>Cordyline fruticosa</i>	X			X	X
'ulei ^{1/ 2/}	<i>Osteomeles anthyllidifolia</i>	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. See "Introduction" on pages 1 and 2.

^{1/} Tolerant of soil salinity and wind-borne salt.

^{2/} Native. **Note: koa and koai'a are susceptible to dieback from koa wilt (mostly below about 2,000 feet).**

^{3/} Potentially invasive species (see "Introduction" on pages 1 and 2). 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

As background information, to select suitable species for riparian forest buffer, the Pacific Island Plant Restoration Database was developed as a management tool for habitat restoration in the Pacific Islands. The program could be accessed via the internet. This database is a Lucid program which is no longer allowed on NRCS computers. Consequently, the link to the plant restoration database does not work and has been removed.

In order to select predominately tree and shrub species for this practice in a client's conservation plan, planners may refer to lists for the following practices: Critical Area Planting (342), Recreation Area Improvement (562), Tree/Shrub Establishment (612), Upland Wildlife Habitat Management (645), and Windbreak/Shelterbelt Establishment (380) in consultation with the PIA State Forester. In order to include other species not listed in the tables in a client's conservation plan, planners are required to obtain the PIA State Forester's approval via email, and except for native species with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

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'					
agati	<i>Sesbania grandiflora</i>	0 - 1	30+	6 x 6	12 x 12
cacao	<i>Theobroma cacao</i>	0 - 1	50+	6 x 6	12 x 12
citrus	<i>Citrus</i> spp.	0 - 1.5	30+	10 x 10	20 x 20
koai'a ^{2/ 3/}	<i>Acacia koaia</i>	0.2 - 6.5	35	6 x 6	12 x 12
kou, tauanave, niyoron ^{2/}	<i>Cordia subcordata</i>	0 - 0.5	20+	10 x 10	20 x 20
langiti ^{2/}	<i>Ochrosia mariannensis</i>	0 - 1	60+	10 x 10	20 x 20
mamane ^{2/ 3/}	<i>Sophora chrysophylla</i>	1.5 - 8	30+	6 x 6	12 x 12
milo, banalo ^{2/ 4/ 7/}	<i>Thespesia populnea</i>	0 - 0.5	20+	10 x 10	20 x 20
panao ^{2/}	<i>Guettarda speciosa</i>	0 - 1	60+	6 x 6	12 x 12
soursop	<i>Annona muricata</i>	0 - 1	30+	10 x 10	20 x 20
Height Class > 35'					
faniok ^{2/}	<i>Tristiropsis obtusangula</i>	0 - 1	60+	10 x 10	20 x 20
ifit ^{2/ 5/}	<i>Intsia bijuga</i>	0 - 1.5	60+	10 x 10	20 x 20
kamani, daok ^{2/ 4/}	<i>Calophyllum inophyllum</i>	0 - 0.5	20+	8 x 8	20 x 20
kauila ^{2/}	<i>Alphitonia ponderosa</i>	0.8 - 4	35+	10 x 10	20 x 20
koa ^{2/ 3/}	<i>Acacia koa</i>	0.2 - 6.5	35+	8 x 8	20 x 20
KX2, KX3, KX4 leucaena hybrids ^{3/}	<i>Leucaena leucocephala</i> subsp. <i>glabrata</i>	0 - 2.5	30+	8 x 8	20 x 20
mahogany	<i>Swietenia mahagoni</i> , <i>Swietenia macrophylla</i>	0 - 1	40+	10 x 10	20 x 20
monkeypod ^{3/}	<i>Samanea saman</i>	0 - 1	40+	8 x 8	20 x 20
neem ^{5/}	<i>Azadirachta indica</i>	0 - 1	30+	10 x 10	20 x 20
nonak ^{2/}	<i>Hernandia sonora</i>	0 - 1	60+	10 x 10	20 x 20
'ohi'a lehua ^{2/}	<i>Metrosideros polymorpha</i>	0 - 8	60+	8 x 8	20 x 20
poumuli	<i>Flueggea flexuosa</i>	0 - 1	60+	10 x 10	20 x 20
puting, fish kill tree ^{2/}	<i>Barringtonia asiatica</i>	0 - 1	50+	10 x 10	20 x 20
teak	<i>Tectona grandis</i>	0 - 1	40+	10 x 10	20 x 20
yoga ^{2/}	<i>Elaeocarpus joga</i>	0 - 1	60+	10 x 10	20 x 20

Note: This list is not all-inclusive. Selections of trees and shrubs may also be made from the following tables: Critical Area Planting (342), Recreation Area Improvement (562), Upland Wildlife Habitat Management (645) and Windbreak/Shelterbelt Establishment (380) in consultation with the State Forester. The Tree/Shrub Establishment (612) list and the above lists may also be used for the selection of trees and shrubs for the Multi-Story Cropping (379) practice in consultation with the State Forester. In order to include other species (not listed in the tables) in a client's conservation plan, planners are required to obtain the PIA State Foresters approval via email, and except for native species with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

^{1/} Unless irrigated.

^{2/} Native. **Note: koa and koai'a are susceptible to dieback from koa wilt at low elevations (below about 2,000 feet).**

^{3/} Nitrogen fixing tree.

^{4/} Tolerant of soil salinity and wind-borne salt.

^{5/} Potentially invasive species (see "Introduction" on pages 1 and 2). In order to include potentially invasive species in a client's conservation plan, planners are required to obtain the PIA State Foresters 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	<i>Heteropogon contortus</i>
'a'ali'i, lampuye	<i>Dodonaea viscosa</i>
'akia	<i>Wikstroemia</i> sp.
'ilima	<i>Sida fallax</i>
mamane	<i>Sophora chrysophylla</i>
'ohelo	<i>Vaccinium reticulatum</i>
popolo	<i>Solanum americanum</i>
pukiawe	<i>Styphelia tameiameia</i>
'uhaloa, escobilla sabana	<i>Waltheria indica</i>

Note: This list is not all-inclusive. In order to include other native 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. Planners are also required to document the approval in the client's conservation plan. See "Introduction" on pages 1 and 2.

**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/ 7/}	<i>Pennisetum purpureum</i>	0.83	15	0 - 3,000	40+
greenpanicgrass ^{2/ 5/} ^{7/} 'Petrie'	<i>Urochloa maxima</i>	0.19	5	0 - 2,500	25 - 70
lemongrass	<i>Cymbopogon citratus</i>	0.19	4	0 - 4,000	50+
'Mott' dwarf elephantgrass ^{4/}	<i>Pennisetum purpureum</i>	0.55	12	0 - 3,000	40+
Napier x pearl millet hybrid ^{4/} 'PMN Hybrid'	<i>Pennisetum purpureum</i> x <i>Pennisetum glaucum</i>	0.53	12 - 15	0 - 3,000	40+
piligrass ^{2/ 3/}	<i>Heteropogon contortus</i>	0.18	5	0 - 2,000	15 - 45
Rhodesgrass ^{2/ 6/} 'Bell', 'Katambora', 'Nemkat' ^{5/}	<i>Chloris gayana</i>	0.19	5	0 - 3,000	25 - 45
'Sunshine' vetivergrass ^{4/ 5/ 6/}	<i>Chrysopogon zizanioides</i>	0.36	8	0 - 3,000	35+
wild cane hybrid ^{4/}	<i>Saccharum</i> hybrid clone <i>Moentai</i>	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, and except for native species with concurrence from the PIA Plant Materials Specialist. Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

^{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" on pages 1 and 2). 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
<i>Cyperus javanicus</i> (marsh cyperus)	Nuts	Coastal marshes, taro lo'i
<i>Cyperus polystachyos</i>	Nuts	Freshwater to brackish
<i>Echinochloa crus-galli</i> (barnyardgrass)	Inflorescence, leaves	Freshwater, taro lo'i
<i>Echinochloa colona</i> (jungle rice)	Inflorescence, leaves	Freshwater
<i>Eleocharis geniculata</i> (spike rush)	Nuts	Freshwater
<i>Eragrostis</i> spp.	Inflorescence	Freshwater to brackish
<i>Fimbristylis</i> sp.	Nuts	Freshwater to brackish
<i>Scirpus</i> sp.	Nuts, stems	Most species are freshwater
<i>Scleria</i> spp.	Nuts	Freshwater to brackish

Note: This list is not all-inclusive. In order to include other native 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. Planners are also required to document the approval in the client's conservation plan. See "Introduction" on pages 1 and 2.

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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/}	<i>Dodonaea viscosa</i>	Moderate	10	0 - 7,000	20+
alaha'e ^{8/}	<i>Psydrax odorata</i>	Moderate	15	0 - 3,000	40+
beach heliotrope, hunig ^{8/ 10/}	<i>Tournefortia argentea</i>	Moderate	20	0 - 1,000	30+
blue vitex, nanulega ^{10/}	<i>Vitex trifolia</i> var. <i>variegata</i>	Rapid	15	0 - 4,000	30+
calamansi	X <i>Citrofortunella mitis</i>	Slow	25	0 - 1,500	30+
croton	<i>Codium variegatum</i>	Slow	15	0 - 2,500	40+
dwarf brassaia	<i>Schefflera arboricola</i>	Rapid	20	0 - 1,000	30+
dwarf Brazilian banana (aka dwarf apple banana), Saba banana (PIA West)	<i>Musa</i> spp.	Rapid	15	0 - 3,500	50+
hibiscus, Chinese, aute	<i>Hibiscus rosa-sinensis</i>	Moderate	15	0 - 3,000	30+
hibiscus, Hawaiian white ^{5/}	<i>Hibiscus</i> spp.	Moderate	15	0 - 3,000	30+
naio ^{8/ 10/}	<i>Myoporum sandwicense</i>	Slow	15	0 - 7,500	30+
naupaka, nanaso ^{8/ 10/}	<i>Scaevola sericea</i>	Moderate	10	0 - 1,000	30+
noni, nonu, lada, Indian mulberry, kesengel ^{10 11/}	<i>Morinda citrifolia</i>	Moderate	20	0 - 1,500	30+
oleander, oliana ^{2/ 10/}	<i>Nerium oleander</i>	Rapid	15	0 - 3,000	30+
panax, tanitani ^{9/}	<i>Polyscias guilfoylei</i>	Moderate	25	0 - 2,000	30+
shell ginger	<i>Alpinia zerumbet</i>	Moderate	10	0 - 2,500	40+
ti	<i>Cordyline fruticosa</i>	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/}	<i>Premna obtusifolia</i>	Moderate	25	0 - 1,000	50+
Australian brush-cherry	<i>Syzygium paniculatum</i>	Moderate	25	0 - 3,000	50+
areca palm	<i>Chrysalidocarpus lutescens</i>	Slow	25	0 - 2,000	40+
avocado ^{3/}	<i>Persea americana</i>	Moderate	30	0 - 2,000	30+
breadfruit, ulu, lemai ^{8/}	<i>Artocarpus altilis</i>	Slow	40	0 - 1,000	40+
breadfruit (seeded), dukduk ^{8/}	<i>Artocarpus mariannensis</i>	Slow	40	0 - 1,000	40+
dwarf coconut palm, niu, nu lius, iru, lu, ni, niyog, nizok	<i>Cocos nucifera</i>	Slow	30	0 - 1,500	40+
fishtail palm	<i>Caryota mitis</i>	Moderate	40	0 - 1,000	60+
gliricidia, madre de cacao ^{7/}	<i>Gliricidia sepium</i>	Rapid	30	0 - 3,000	25+
hala, kafu, ongor, fasa ^{8/ 10/} pahong	<i>Pandanus tectorius</i> <i>Pandanus dubius</i>	Moderate	25	0 - 500	40+
koai'a ^{5/ 7/ 13/}	<i>Acacia koaia</i>	Moderate	25	300 - 6,500	35+
kou, tauanave, niyoron ^{8/ 10/}	<i>Cordia subcordata</i>	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	<i>Ptychosperma macarthurii</i>	Slow	30	0 - 2,000	20+
mamane ^{5/ 7/}	<i>Sophora chrysophylla</i>	Moderate	40	1,500 - 8,000	30+
milo, binalo, rosewood, badirt, banalo, kilulo, panu, polo, pone, bang-beng ^{8/ 10/ 11/}	<i>Thespesia populnea</i>	Moderate	35	0 - 500	20+
podocarpus fern pine ^{3/}	<i>Podocarpus gracilior</i>	Moderate	40	0 - 1,500	60+
seagrape ^{10/}	<i>Coccoloba uvifera</i>	Moderate	25	0 - 1,000	30+
weeping bottlebrush	<i>Callistemon viminalis</i>	Moderate	25	0 - 2,500	30+
Height Class Tall (T)= height greater than 40 feet (spacing between plants within row: 6 to 15 feet)					
brushbox	<i>Lophostemon confertus</i>	Rapid	60	0 - 3000	40+
callitris	<i>Callitris</i> spp.	Slow	100	100 - 2000	50+
Chinese fir	<i>Cunninghamia lanceolata</i>	Moderate	80	2,000 - 6,000	40+
coconut palm, niu, lius, iru, lu, ni, niyog, nizok, nu ^{10/ 14/}	<i>Cocos nucifera</i>	Slow	60	0 - 1,500	20+
Cook pine ^{10/}	<i>Araucaria columnaris</i>	Moderate	100	0 - 3,000	30+
false kamani, talie, talisai, miich, tropical almond ^{8/ 10/}	<i>Terminalia catappa</i>	Moderate	85	0 - 1,000	40+
fermtree	<i>Filicium decipiens</i>	Moderate	45	0 - 1,000	60+
ifit, ifil, ipil, ifilele, choyo, dort, kubok, kuren ^{8/ 13/}	<i>Intsia bijuga</i>	Moderate	50	0 - 1,500	60+
ironwood, toa, gagu, laash, ngas, mejinoki, weeku ^{7/ 10/ 12/}	<i>Casuarina equisetifolia</i>	Rapid	70	0 - 2,500	30+
Italian cypress	<i>Cupressus sempervirens</i>	Slow	60	0 - 4,000	30+
jackfruit	<i>Artocarpus heterophyllum</i>	Moderate	50	0 - 3,000	60+
Japanese sugi pine	<i>Cryptomaria japonica</i>	Moderate	70	1,500 - 6,000	50+
kamani, daok, btaches, fetau, biyuch, eet, isou, lueg, rakich ^{8/ 10/}	<i>Calophyllum inophyllum</i>	Slow	60	0 - 500	20+
koa ^{5/ 7/ 13/}	<i>Acacia koa</i>	Slow	75	300 - 6,500	35+
kukui, lama, lumbang, sakan, raguar, candlenut tree ^{11/}	<i>Aleurites moluccana</i>	Moderate	50	0 - 2,000	30+
Lawson's cypress	<i>Chamaecyparis lawsoniana</i>	Moderate	50	2,500 - 6,000	40+
mahogany ^{10/}	<i>Swietenia mahagoni</i>	Slow	60	0 - 1,000	40+
mahogany (broad-leaved)	<i>Swietenia macrophylla</i>	Moderate	60	0 - 1,000	40+
manele, soapberry ^{8/}	<i>Sapindus saponaria</i>	Moderate	60	0 - 4,000	50+
mango, kangit, idele, mago, mangueira	<i>Magnifera indica</i>	Slow	60	0 - 2,000	40+
Monterey cypress ^{9/}	<i>Cupressus macrocarpa</i>	Slow	70	1,500 - 5,000	40+

**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)
Norfolk Island pine ^{10/}	<i>Araucaria heterophylla</i>	Moderate	100	0 - 3,000	30+
'ohi'a lehua ^{8/}	<i>Metrosideros polymorpha</i>	Slow	80	0 - 8,000	60+
pink tecoma	<i>Tabebuia heterophylla</i>	Moderate	45	0 - 500	20+
Portuguese (Mexican) cypress	<i>Cupressus lusitanica</i>	Moderate	45	0 - 3,000	40+
poumuli	<i>Flueggea flexuosa</i>	Moderate	45	0 - 1,000	60+
small cone ironwood ^{7/ 11/}	<i>Casuarina cunninghamiana</i>	Rapid	70	0 - 3,000	30+
tamarind ^{7/ 10/}	<i>Tamarindus indica</i>	Slow	75	0 - 1,000	30+
turpentine tree	<i>Syncarpia glomulifera</i>	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 Forester's approval via email with concurrence from the PIA Plant Materials Specialist (except for native species). Planners are also required to document the approval/concurrence in the client's conservation plan. See "Introduction" on pages 1 and 2.

^{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

^{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" on pages 1 and 2). 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.

^{12/} In the PIA West Area, this species is approved for planting because it is native. **Caution: in Guam it is susceptible to ironwood tree decline disease.** In American Samoa, this species is considered to be potentially invasive, thus planners are required to obtain the PIA State Forester'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.**

^{13/} Susceptible to the koa wilt disease (*Fusarium oxysporum* f. sp. *koae*) - a soil-borne disease which is more often seen on trees planted at low elevations (below approximately 2,000 feet).

^{14/} Plant the tall coconut palm in a multiple-row windbreak with other species, so the lower portion is filled-in when the coconut palm is full grown because at this stage of growth the fronds are only near the top of the plant. In Guam, coconut and other palms are susceptible to attack by the coconut rhinoceros beetle (*Oryctes rhinoceros*) which can cause serious damage to the trees.

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