

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION
WINDBREAK/SHELTERBELT ESTABLISHMENT
(feet)
CODE 380

SCOPE

This document establishes the technical details, workmanship, and quality and extent of materials required to install the practice in accordance with the Conservation Practice Standard. The information shall be considered when preparing site-specific specifications for the practice.

The NRCS Hawaii Jobsheet for this practice shall be used to document the site-specific specifications for installing, operating, and maintaining the practice on a specific field or treatment unit. Other documents (worksheets, maps, drawings, and narrative statements in the conservation plan) may be used in addition to the Jobsheet to document site specifications or to plan or design the practice.

SPECIES SELECTION

Refer to Table 1 for a list of the species suitable for windbreaks and choose those most compatible with the landowner's wishes, windbreak design, soils and local growing conditions. The Table and pictures of most of the plants are also included in the Hawaii Vegetative Guide available online at: <ftp://ftp-fc.sc.egov.usda.gov/HI/pub/technotes/vegetative/>.

To help ensure against loss of wind protection due to fire, insects, diseases, and other destructive forces such as hurricanes, it is advisable to plant a variety of species. In a multiple row windbreak, several species should be used - one or two rows of each kind. Each row should be comprised of a single species.

To ensure uniformity in height and density of a row, do not mix species within a row. Plant fruit bearing trees on the inside of a multiple row windbreak.

SPACING

If mechanized maintenance is planned, space rows to accommodate the size of equipment to be used. Space the rows at least 4 feet wider than the equipment that will be used. Plan the row spacing based on the mature size of the trees.

Plant spacing depends not only on tree size, but on species and availability of moisture as well. The following plant spacings apply to field, farmstead and feedlot windbreaks.

Spacing Between Rows

Adjacent Row Height Class	Spacing Between Rows (feet)
Short (S)	5 to 10
Medium (M)	6 to 15
Tall (T)	8 to 20

Spacing Between Plants Within a Row

Row Height Class	Spacing Between Plants (feet)
Short (S)	2 to 6
Medium (M)	3 to 10
Tall (T)	6 to 15

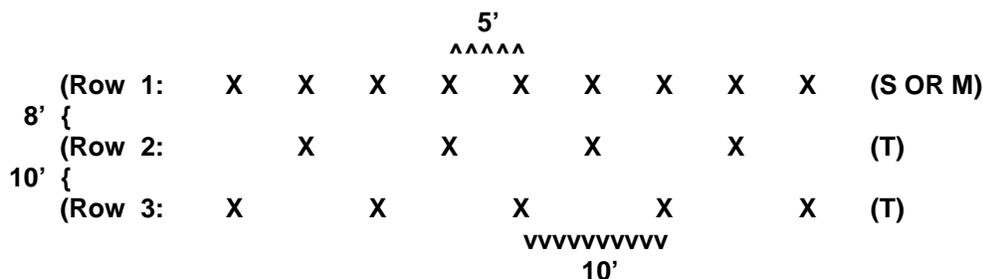
Spacing for Single-Row Windbreaks

Use spacing in the lower part of the above ranges for single row windbreaks. To determine the area (acres) of a single-row field windbreak, the following widths will be used for each height class:

Row Height Class	Width (feet)
Short (S)	10
Medium (M)	20
Tall (T)	30

Spacing for Multiple-Row Windbreaks

The trees will be staggered in a multiple-row windbreak. Example of a three row windbreak:



INSTALLATION PROCEDURES

Good planting stock will be used. Potting bare-root stock 3 to 4 months before planting will help produce more vigorous transplants. Dibble tube stock may be used if available and is preferred to bare-root stock. Cuttings may be rooted in pots or beds, then transplanted. Unrooted cuttings may be planted directly in the windbreak row, depending on the species, available moisture and other conditions.

Site Preparation

Control competitive grasses or shrubs where windbreaks are to be planted. Good site preparation will promote rapid growth and survival of plants. Till and subsoil as needed. If individual planting holes are dug through sod or untilled ground, make these as large as practicable and clear a 3-foot diameter circle around each plant at the time of planting.

Planting

Take care of planting stock. If bare-root stock is not planted immediately, it should be "heeled-in" a V-shaped trench under shade or potted and kept moist.

Plant bare-root stock slightly deeper than they were in the nursery.

Mulching around the seedlings will help to conserve moisture and control weeds. Organic mulches, cinders and plastic mulches are effective.

Plant stock, particularly bare-root stock, during the wet season.

Plant stock either in a furrow or individual holes. Do not bend or crowd the roots.

Fertilization

Apply lime and fertilizer according to soil test results and recommendations.

Follow up with fertilizer as needed according to soil test recommendations. Consider possible effects on water quality from deep percolation and run-off. Refer to the **Nutrient Management Standard (Code 590)**.

Table 1. Suitable Species (Page 1 of 2)

Common Name	Scientific Name	Relative Growth Rate	Approx. 20-year Height (feet)	Adaptation	
				Elevation (feet)	Rain fall ^{1/} (inches)
Height Class Short (S)= height to 20 feet (spacing between plants within row: 2 to 6 feet)					
'a'ali'i ^{8/}	<i>Dodonaea viscosa</i>	Moderate	10	0 - 7,000	20
alaha'e ^{8/}	<i>Canthium odoratum</i>	Moderate	15	0 - 3,000	40
beach heliotrope ^{10/}	<i>Tournefortia argentea</i>	Moderate	20	0 - 1,000	30
beach naupaka ^{8/ 10/}	<i>Scaevola sericea</i>	Moderate	10	0 - 1,000	30
beefsteak	<i>Acalypha wilkensisiana</i> var. <i>marginata</i>	Rapid	15	0 - 4,000	30
blue vitex ^{10/}	<i>Vitex trifolia</i> var. <i>variegata</i>	Rapid	15	0 - 4,000	30
croton	<i>Codium variegatum</i>	Slow	15	0 - 2,500	40
dracaena	<i>Dracaena fragrans</i> or <i>D. dermensis</i>	Moderate	15	0 - 2,000	50
dwarf brassaia	<i>Schefflera arboricola</i>	Rapid	20	0 - 1,000	30
heen naran (seedy tangerine)	<i>Citrus lycopersicaeformis</i>	Slow	15	0 - 1,500	30
hibiscus, Chinese	<i>Hibiscus rosa-sinensis</i>	Moderate	15	0 - 3,000	30
hibiscus, native ^{8/}	<i>Hibiscus</i> spp.	Moderate	15	0 - 3,000	30
nai'o ^{8/ 10/}	<i>Myoporum sandwicense</i>	Slow	15	0 - 7,500	30
noni ^{8/ 10/} (Indian mulberry)	<i>Morinda citrifolia</i>	Moderate	20	0 - 1,500	30
oleander ^{2/ 10/}	<i>Nerium oleander</i>	Rapid	15	0 - 3,000	30
panax ^{9/}	<i>Polyscias guilfoylei</i>	Moderate	15	0 - 2,000	30
shell ginger	<i>Alpinia zerumbet</i>	Moderate	10	0 - 2,500	40
ti ^{8/}	<i>Cordyline fruticosa</i>	Rapid	10	0 - 6,000	30
Height Class Medium (M)= height 20 to 40 feet (spacing between plants within row: 3 to 10 feet)					
areca palm	<i>Chrysalidocarpus lutescens</i>	Slow	25	0 - 2,000	40
athel tamarisk ^{4/ 10/ 11/}	<i>Tamarix aphylla</i>	Rapid	25	0 - 1,000	25
avocado ^{3/}	<i>Persea americana</i>	Moderate	30	0 - 2,000	30
Bermuda juniper	<i>Juniperus barbadensis</i>	Moderate	40	0 - 3,500	40
breadfruit ^{8/}	<i>Artocarpus communis</i>	Slow	40	0 - 1,000	40
copalchi croton	<i>Croton reflexifolius</i>	Moderate	30	0 - 2,500	40
dwarf coconut palm	<i>Cocos nucifera</i>	Moderate	30	0 - 1,500	20
fishtail palm	<i>Caryota mitis</i>	Moderate	40	0 - 1,000	60
gliricidia ^{7/}	<i>Gliricidia sepium</i>	Rapid	30	0 - 1,000	40
hala ^{8/ 10/}	<i>Pandanus tectorius</i>	Moderate	30	0 - 2,000	40
koai'a ^{7/ 8/}	<i>Acacia koaia</i>	Moderate	25	1,000 - 6,000	30
kou ^{8/ 10/}	<i>Cordia subcordata</i>	Moderate	35	0 - 500	30
Macarthur palm	<i>Ptychosperma macarthurii</i>	Slow	30	0 - 2,000	20
mamane ^{7/ 8/}	<i>Sophora chrysophylla</i>	Moderate	40	1,500 - 8,000	30
milo ^{8/ 10/}	<i>Thespesia populnea</i>	Rapid	30	0 - 2,000	30
podocarpus fern pine ^{3/}	<i>Podocarpus gracilior</i>	Moderate	40	0 - 1,500	60

Table 1. Suitable Species (Page 2 of 2)

Common Name	Scientific Name	Relative Growth Rate	Approx. 20-year Height (feet)	Adaptation	
				Elevation (feet)	Rainfall ^{1/} (inches)
seagrape ^{10/}	<i>Coccoloba uvifera</i>	Moderate	25	0 - 1,000	30
tall erythrina cv. Tropic Coral ^{5/ 7/}	<i>Erythrina variegata</i>	Rapid	40	0 - 1,000	50
wiliwili ^{7/ 8/}	<i>Erythrina sandwicensis</i>	Rapid	30	0 - 1,000	25
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 ^{8/ 10/}	<i>Cocos nucifera</i>	Moderate	60	0 - 1,500	20
Cook pine ^{10/}	<i>Araucaria columnaris</i>	Moderate	100	0 - 3,000	40
ferntree	<i>Filicium decipiens</i>	Moderate	45	0 - 1,000	60
Italian cypress	<i>Cupressus sempervirens</i>	Slow	60	0 - 4,000	30
jackfruit	<i>Artocarpus heterophyllum</i>	Moderate	50	0 - 1,000	60
Japanese sugi pine	<i>Cryptomaria japonica</i>	Moderate	70	1,500 - 6,000	50
kamani ^{8/ 10/}	<i>Calophyllum inophyllum</i>	Slow	50	0 - 2,000	50
koa ^{7/ 8/}	<i>Acacia koa</i>	Slow	75	1,500 - 7,000	50
kukui ^{4/ 8/} (candlenut tree)	<i>Aleurites moluccana</i>	Moderate	50	0 - 2,000	50
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 ^{8/}	<i>Sapindus saponaria</i>	Moderate	60	0 - 4,000	50
mangium ^{4/ 7/}	<i>Acacia mangium</i>	Rapid	80	0 - 2,000	40
mango, common	<i>Magnifera indica</i>	Slow	60	0 - 2,000	40
Monterey cypress ^{6/}	<i>Cupressus macrocarpa</i>	Slow	70	1,500 - 5,000	40
Norfolk Island pine ^{10/}	<i>Araucaria heterophylla</i>	Moderate	100	1,500 - 3,000	40
'ohi'a lehua ^{8/}	<i>Metrosideros polymorpha</i>	Slow	80	0 - 8,000	60
Portuguese (Mexican) cypress	<i>Cupressus lusitanica</i>	Moderate	45	0 - 3,000	40
small cone ironwood ^{7/ 11/}	<i>Casuarina cunninghamiana</i>	Rapid	70	0 - 3,000	40
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. Species other than those listed may be selected for this practice based on prescriptions by qualified technical specialists.

^{1/} Minimum moisture requirement. Most plants (except for some dry land natives) need approximately 1" of moisture per week for normal growth (see relative growth rate column).

^{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/} Establish with cuttings or other asexual means. Will not grow true to type from seed.

^{6/} Use in deeper soils only.

^{7/} Nitrogen fixing tree.

^{8/} Native to Hawaii or early Polynesian introduction.

^{9/} Ground termites can get into the dead wood portion of the stem.

^{10/} Highly tolerant of soil salinity and wind-borne salt.

^{11/} May have potential to become invasive.