

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

WINDBREAK/SHELTERBELT ESTABLISHMENT
(Feet)
CODE 380

DEFINITION

Linear plantings of single or multiple rows of trees or shrubs established for environmental purposes.

PURPOSES

- * Reduce wind erosion.
- * Protect growing plants.
- * Manage snow.
- * Provide shelter for structures and livestock.
- * Provide wildlife habitat.
- * Provide a tree or shrub product.
- * Provide living screens.
- * Improve aesthetics.
- * Improve irrigation efficiency.

CONDITIONS WHERE PRACTICE APPLIES

On any areas where woody plants are suited.

CRITERIA

General Criteria Applicable To All Purposes Named Above

The location, layout and density of the planting will accomplish the purpose and function intended within a 20 year period.

The maximum design height (H) for the windbreak or shelterbelt shall be the expected height of the tallest row of trees or shrubs at age 20 for the given site.

Species must be suitable and adapted to the soils, climate and purpose.

Only viable, high quality and adapted planting stock or seed will be used.

The planting shall be done at a time and manner to insure survival and growth of selected species.

The planting will be protected from adverse impacts such as livestock damage or fire.

Avoid planting trees or shrubs where they will interfere with structures or any above or below ground utilities.

Moisture conservation or supplemental watering must be provided for plant establishment and growth where natural precipitation is too low for the selected species.

**Additional Criteria To Reduce Wind Erosion:
Protect Growing Plants**

The windbreak will be oriented as close to perpendicular to the troublesome wind as possible. The interval between windbreaks shall be determined using current, approved, wind erosion technology to achieve the quality level for the soil or plant resource. The distance sheltered by the barrier will vary from 5 times to 20 times the design height (H) dependent upon the purpose of the windbreak.

The wind erosion control system should consider temporary measures to supplement the windbreak until it is fully functional.

Additional Criteria To Manage Snow

The windbreak will be oriented as close to perpendicular to the snow-bearing wind as possible.

For snow distribution, the maximum windbreak density will be 65 percent and the interval between barriers will not exceed 20H.

For snow accumulation, the minimum barrier density will be 50 percent and the windward row will be at least 100 feet from the area to be protected.

Windbreaks will be located so that snow deposition will not adversely impact the area to be protected.

In MLRA 21, 22, 23, and 26 where buildings, roads, feedlots or other establishments are to be within protected area, the windbreak will be placed at least 100 feet upwind to minimize snow drift problems.

Additional Criteria To Provide Shelter For Structures And Livestock

The planting will be oriented as close to perpendicular to the troublesome wind as possible.

For wind protection, the minimum barrier density will be 65 percent and the area to be protected will fall within 10H of the design height.

Additional Criteria For Screens

Noise screens shall be dense, as tall as, and as close to the noise source as practicable.

Visual screens shall be located as close to the observer as possible.

Design Criteria

Do not create blind corners at road intersections.

Do not plant closer than 30 feet from the edge of the right-of-way.

All soils within a windbreak shall be suitable for growing trees. Windbreaks shall be laid out at approximately right angles to the prevailing winds. The windbreak shall consist of at least a single-row main windbreak.

Isolation strips will be maintained on all plantings for a minimum of 8 feet or the width of the cultivation equipment plus 4 feet. Minimize fire hazards by keeping isolation strips clear of crop residues, weeds and trash. An isolation strip is prescribed to protect the planting from fire, exclude grass and weeds and help control rodent invasion.

Windbreaks must be protected from livestock through the use of adequate fencing. (See Fencing Standard and Specification #382 and Use Exclusion #472).

The windbreak will consist of at least one row of adapted trees or shrubs.

Subsequent belts should be placed at 10 to 20 times the expected height of the belt at 20 years of age.

Where space permits, extend windbreaks 50 feet beyond areas to be protected to minimize eddying effects.

Avoid creating frost pockets with field windbreak plantings. Where danger of frost can be a problem, prune lower limbs of the plantings to allow for adequate air drainage.

If more than one row is used in a field windbreak, the spacing between the rows will generally be from 10 to 20 feet for shrub rows, and a minimum of 20 feet for tree rows. Plan the row spacing to fit the operator's equipment, adding a minimum of 4 feet to the width of the cultivation equipment.

CONSIDERATIONS

Spacing between windbreaks and rows of windbreaks may be adjusted to accommodate widths of equipment.

Selection of plants for use in windbreaks should favor species or varieties tolerant to herbicides used in the area.

Plants which may be alternate hosts to undesirable pests should be avoided.

All plantings should compliment natural features.

Where water erosion and/or runoff from melting snow is a hazard, it should be controlled by supporting practices.

Wildlife needs should be considered when selecting tree or shrub species.

Species diversity should be considered to avoid loss of function due to species specific pests.

Consideration should be given to adverse offsite effects.

Planning Considerations

Avoid creating blind corners at road intersections; do not plant closer than 30 feet from the edge of the right-of-way. On the windward side of a road, the nearest tree row should be no closer than approximately 50 feet from the edge of the right-of way. For plantings under or immediately adjacent to power, telephone and

similar aboveground facilities, use shrub or small tree species.

Field windbreaks will be planted approximately at right angles to prevailing wind.

Field windbreaks will be protected during the life of the windbreak from livestock and poultry. Fencing will be installed to exclude livestock when grazing is the planned use in adjacent fields (see Fencing standards and specifications).

One or more rows of conifers or evergreens should be included in each planting.

Species selection should be given careful consideration to minimize possible conflict between windbreak plantings and crops to be grown. Use local or known plant sources whenever possible.

If root pruning is planned to control shallow roots do not prune inside the drip line and not deeper than two feet. Prune each side every third year.

Instead of trees with shallow root systems and large numbers of suckers, such as Lombardy poplar, fruitless mulberry, and honeylocust, consider species with deeper non-suckering root systems. Proper irrigation tends to develop deeper root systems.

Field windbreaks should be designed to allow for about 50 percent porosity. At about 50 percent density, the best overall protection is afforded.

Screen plantings should be located to provide optimum screening of the unsightly areas from public view.

Plant screens for noise control as close as practical to the source of troublesome noise. Incorporate ground features such as earth mounds where possible for additional noise control.

An isolation strip is a planned, cultivated area around a field windbreak to protect the windbreak plantings from competition and fire. Minimize fire hazards by keeping isolation strips clear of crop residues, weeds, and trash.

Incorporating farm access roads to serve as isolation strips for wind barriers should be considered where possible.

Species that have more aesthetic values should be included in the planting plan where possible.

Where natural beauty is a primary objective in the type of planting, species that are evergreen or those that have features such as showy flowers, brilliant fall foliage or persistent colorful fruits should be used.

Recreation areas should have windbreaks that are denser than normal field windbreaks. Windbreaks should be placed to provide optimum protection from prevailing winds during the periods of heaviest expected use.

A single species will normally be used in a row except where soil type dictates a change or where the species to be mixed are compatible. Mixed species should be planted in groups of 12 or more.

Tall growing tree species must not be planted where they could interfere with power, telephone lines, or similar facilities. Tall growing trees should be planted so they will not shade nearby roads and prevent solar radiation from melting accumulations of ice or snow. Immediately adjacent to power, telephone and similar above ground facilities, use shrub or small tree species.

Plant materials should be ordered as early as practical in order to have the best selection and insure availability.

Considerations should be given to include the use of a snow fence, shingles, or other suitable materials on one or more sides of individual plants to reduce wind damage to new plantings.

Large trees with shallow root systems must not be planted near buildings or structures. Shallow soils (less than 20 inches deep) and soils with toxicity problems will require a detailed on-site investigation.

In areas where blowing snow and/or sand are problems, windbreaks should be located at least 100 feet away from the area to be protected.

Avoid creating wind tunnels by crossing the windbreak with roads, ditches, or driveways set at oblique angles to the wind.

If possible, place windbreaks on the windward side of ridge tops instead of the top of the ridge.

Leave enough room at each end for cultivation equipment to make adequate turns.

On slopes of less than 6 percent, plant field windbreaks at right angles to the prevailing winds, consistent with cropping and ownership pattern.

On slopes greater than 6 percent, plant field windbreaks on the contour consistent with the cropping and ownership patterns and as close to right angles to prevailing winds as possible.

The area protected from wind erosion is dependent upon the density and height of the windbreaks, the spacing between windbreaks, and the orientation of the windbreak with respect to prevailing and troublesome winds. These characteristics of windbreaks also influence moisture distribution within a field. Transpiration of large vegetation (trees) will draw down soil moisture within and in the proximity of the windbreaks. An increase in soil moisture may occur in areas because of moderate or large snowfalls. Multiple windbreaks could be used to manage snow catch and distribution across fields. Snow catch would increase the amount of water infiltrated and seasonally increase soil moisture. Single primary windbreaks will have localized effects on soil moisture. Localized areas of extensive snow catch or drift could be subject to an increase in infiltration and deep percolation during snowmelt, which could act to elevate a water table.

Wildlife and Beautification Values

When landowners are interested in wildlife values planning considerations should consider food and cover requirements for wildlife.

Wildlife values can be enhanced by including one or more rows of shrubs, shrub-like trees or conifers on the leeward side.

All sites and all plant species may be subject to unacceptable damage due to browsing or grazing and protection will be required to hold damages to an acceptable level. Planning will include preparing estimates of the occurrence of animal populations, which have the potential of causing damage. Use of sightings of gopher mounds, animal trails, frequency of scat, and evidence of browsing on native plants will yield data that can help determine the need for plant protection.

On certain sites all species will be subject to unacceptable damage which on other sites no species may be subject to damage and plant protection may not be necessary.

Where a choice of several species exists, those species having higher value to wildlife should be used.

Where natural beauty is a primary objective in this type of planting, species that are evergreen, or those that

have features such as showy flowers, brilliant fall foliage or persistent colorful fruits should be used.

Water Quantity

Decreased wind velocity and flow over protected areas near windbreaks have shown an increase in infiltration and soil moisture due to decreased surficial evaporative demand. Increased transpiration in the vicinity of the windbreak itself will occur due to the establishment of larger vegetation (trees) which will act to draw down soil moisture. Consideration must be given to snow drift areas and distribution adjacent to windbreaks, which will cause a local increase in surface or ground water.

Water Quality

In areas of heavy snow fall increased local soil water due to concentrated snow catch areas may lead to rising water tables and induce a salinity problem where one did not exist prior to the windbreak establishment. The location of a feedlot or the windbreak should be such that snow drift on the side opposite the direction of the prevailing winds does not occur in an area where snow melt would be carried across the feedlot area. Runoff from snowmelt across a feedlot would have the potential to detach, solubilize and/or transport sediment, nitrates, phosphates, pathogens, metals, and organic substances.

Wind erosion should be reduced by the windbreak. Creep, saltation, and suspension of the sediment are the specific mechanisms of wind erosion which will be affected. A reduction in the detachment and transportation of sediment leads to reduced amounts of sediment reaching watercourses. Decreases in sediment yield to watercourses are dependent on the reduction of wind erosion due to the windbreak. In areas where salt deposits exist or ground waters are saline, some considerations must be given as to how to avoid contamination of unaffected areas by sources of salinity. Species selection could be important to lower saline water tables and to escape inducing salinization of soils and surface or interflow waters. Characteristics of a windbreak which can be controlled in order to improve overall water quality include height and density of the windbreak, spacing between windbreaks (primary, secondary, etc. windbreaks), and orientation of the windbreak with respect to the prevailing and troublesome winds.

Endangered Species Considerations

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species.

If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Row Arrangement Examples:

A five-row windbreak using different species and adequate spacing provides the most effective protection. One row, well developed, is better protection than three rows with inadequate spacing. Acceptable composition is listed from windward to leeward in order of preference.

Row	Type Plant
FIVE ROW WINDBREAK	
1	Shrub
2	Medium ht. deciduous or evergreen tree
3	Tall deciduous or evergreen tree
4	Tall evergreen or deciduous tree
5	Medium ht. evergreen or deciduous tree

Row	Type Plant
FOUR ROW	
1	Shrub
2	Medium ht. deciduous or evergreen tree

- 3 Tall deciduous or evergreen tree
- 4 Medium ht. deciduous or evergreen tree

THREE ROW

- 1 Shrub
- 2 Tall or medium ht. deciduous or evergreen tree
- 3 Tall or medium ht. deciduous or evergreen tree

TWO ROW - First Option

- 1 Medium ht. evergreen tree
- 2 Tall evergreen tree

TWO ROW - Second Option

- 1 Dense shrub
- 2 Tall evergreen tree

ONE ROW - First Option

- 1 Tall evergreen tree

ONE ROW - Second Option

- 1 Medium or tall deciduous tree

Spacing

Spacing Between the Rows in Multiple Row Windbreaks

Precipitation (in.)	Spacing (feet)
<12	22-30
>12	18-26
irrigated	20-24

The choice of spacing will be influenced by the width of cultivation equipment to be used and the amount of land available for planting. Figure the width of the equipment plus four feet.

Spacing Within the Rows in Multiple Row Windbreaks

Low shrubs	3 to 5 ft. a part
Tall shrubs	8 to 12 ft a part

Trees 8-10 ft ^{2/} a part

Spacing in Single Row Windbreaks

Trees only 8 to 10 ft a part
Shrubs only 3 to 5 ft a part

Sufficient deviations are allowed to adapt species spacing to fit cooperators needs and requirements of the soil.

Species Suitability

These ratings are based on adequate site preparation, quality planting and planting stock, and clean cultivation.

For recommended plant species see California Woodland Tech Note #25 and Vegetative Guide in

Individual Tree Protection

Based on limited observations the following species normally require protection to control damage due to browsing or grazing to an acceptable level:

native plumb	skunkbush sumac
fourwing saltbush	Douglas-fir
ponderosa pine	dogwood
poplar spp.	white fir
willow spp.	golden willow
green ash	lilac
mulberry	aspen
Afghanistan pine	birch spp.
Arizona cypress	

Plant Stock and Care of Seedlings

Planting stock should be ordered early enough to assure availability, and to achieve cost effectiveness where possible.

^{2/} Columnar shaped trees, such as Lombardy poplar, should be spaced at 8 feet. Other trees should usually be spaced as follows: Deciduous trees, 10-14 feet; Coniferous trees, 8-10 feet; small to medium size deciduous trees, 6-10 feet.

Proper care of seedlings at all times, from lifting at the nursery to the actual planting, cannot be over-emphasized. Negligence at any of these stages can cause complete failure regardless of the care taken when planting. Do not obtain seedlings from the nursery until shortly before planting is to begin.

Bareroot:

Keep seedling roots moist at all times, from the time they are removed from the bale until they are planted. Seedlings may be stored in bales for a short period of two or three days. Extreme care must be taken, however, to make sure roots do not dry out, that the seedlings do not heat, and reasonable efforts must be made to keep them from freezing. Seedling bales must be watered at least once every 48 hours and protected against sun and wind, yet well ventilated. Seedling bales should be examined daily and shifted as necessary to avoid heating. Where freezing occurs the bales should not be handled, but left until completely thawed out by warmer weather. Where it is necessary to store seedlings for periods in excess of three days, it is better to heel them out in thin layers and bed them in a sandy or loamy soil and make sure they remain moist.

Extreme care must be taken to keep seedling roots from becoming dried out while planting. Dry soil on the roots is evidence that seedlings are not being cared for properly. Ample water, or a water-saturated material, must be kept in all planting containers to make sure the seedling roots remain moist.

Container

Seedlings should be stored in an area which provides shade and is protected from temperatures below 34° F or greater than 40° F and from winds in excess of 5 to 7 mph. The soil medium needs to be checked daily and the soil medium needs to be moist.

Planting

Machine planting or hand planting with any tool that will accomplish desirable results is acceptable. Machine furrows or holes made with hand tools must be free of trash. Planting should be done under optimum moisture conditions, that is, when the soil is neither too dry nor too wet. An exception may be the planting of trees or shrubs where each plant is given individual attention in planting and facilities for watering are available. Do not plant during freezing weather or when the ground is frozen. Avoid planting on hot, dry, windy days.

Special attention to the actual planting operations is essential to the establishment of windbreaks:

Depth - Plant each seedling at the same depth or slightly deeper (1 inch) than it grew in the nursery.

Condition of Roots - Plant seedling roots straight down, not twisted, balled, or U-shaped. Roots must extend 8 to 12 inches below the ground surface.

Pruning - Do not prune tops or roots. The nursery practice of pruning the roots to about 10 inches when lifting has made further pruning unnecessary and is, therefore, not required.

Straightness - Plant seedlings as near vertical as possible.

Firmness - Pack the soil firmly around the planted seedlings with no air pockets left in machine furrows or dibble holes.

Seedlings Per Space - Plant only one seedling per planting space.

Replacement of dead trees or shrubs will be continued annually until the barrier is functional.

Vegetative competition will be controlled.

Supplemental water will be provided as needed.

Thin the barrier to maintain its function.

Damaging pests will be monitored and controlled.

Periodic applications of nutrients may be needed to maintain plant vigor.

Irrigation

The irrigation system for each windbreak shall be designed and installed prior to planting. Except in MLRA 4, field windbreaks shall receive supplemental irrigation for the first three years after planting (see applicable IRRIGATION SYSTEM standards and specifications).

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded on the Barrier Planting Plan, CA-ECS-1.

Site Preparation see Forest Site Preparation – Specification 490.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance):