NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE GENERAL SPECIFICATION

WINDBREAK/SHELTERBELT ESTABLISHMENT (Ft.) CODE 380

GENERAL SPECIFICATIONS

Procedures, technical details, and other information listed below provide additional guidance for carrying out selected components of the named practice. This material is referenced from the conservation practice standard for the named practice and supplements the requirements and considerations listed therein.

Site preparation for this practice may adversely affect significant cultural resources and should be submitted to a cultural resource specialist for a determination of impacts before the practice commences.

Where a high degree of protection from blowing soil to prevent crop damage is desired, spacing intervals will be determined by using current soil erosion estimation methods (i.e., WEQ or WEEP).

LOCATION OF WINDBREAKS OR SHELTERBELTS

Windbreaks or shelterbelts will be located as close to perpendicular to the seasonal prevailing wind direction as possible. They should be placed on the upwind side of the area to be protected. The purpose and design of each windbreak is unique, and the orientation of each installation depends upon the design objectives.

HEIGHT

The height of a windbreak helps to determine the extent of the protected area. Average height (H) of the tallest tree row in the break is used to calculate the wind speed reduction distance resulting from the windbreak. A distance equal to **2 to 5 times** this height is protected on the windward side of a windbreak, and wind speed reductions on the leeward side of the barrier occur up to **30 times** this height.

LENGTH

The length of the windbreak rows also determines the total area receiving protection. For maximum protection, the length of the windbreak should be at least 10 times its height.

Extend the length of the windbreak 100 feet beyond the area to be protected for best results.

There should be no gaps in the windbreak length. Access lanes, roads, firebreaks, and similar installations should be located at the end of a windbreak. If this is not possible, then they should be located so that the opening is at an angle to problem winds. Otherwise wind will funnel through the gaps in the windbreak, and the efficiency of the windbreak will be greatly reduced.

DENSITY

Windbreak density is the ratio of the solid portion of the barrier to the total area of the barriers. The density of the woody material within the windbreak or shelterbelt affects how well the trees absorb and deflect some of the energy of the wind. Density is controlled by adjusting the species planted, their arrangement within the rows, number of rows, distance between rows, and the spacing within the rows.

A windbreak density of 40 to 60 percent provides the greatest downwind area of protection and provides excellent soil erosion control. Typically, these windbreaks have two or three rows of conifers, one or two rows of tall hardwoods, and one or more rows of shrubs.

Generally, optimum windbreak densities will comply with the following structure:

Purpose	Density	# of Rows
Crop protection	40-50%	1-2
Farmstead. protection	50-60%	3
Livestock protection	50-60%	5
Noise Screen	65-70%	3-5

The maximum density of a windbreak will not exceed 70% for any purpose. See Figure 1 for wind speed reductions for various windbreak densities.

PLANTING

Refer to the conservation practice standards for Tree/Shrub Establishment (Code 612) and Tree/Shrub Site Preparation (Code 490) for tree and shrub installation specifications.

Multiple rows provide better benefits and a wider variety of benefits.

Woody plant species selection will incorporate objectives of the landowner. Plant species chosen will benefit targeted wildlife species. To enhance aesthetics, use evergreen species or species with features such as showy flowers, brilliant fall foliage, or persistent colorful fruits.

The minimum spacing between rows for multiple row plantings is 12 feet, and the maximum spacing is 20 feet. Trees with an overtopping crown spread, such as elm and cottonwood, will not be planted within 16 feet of a pine row.

In all cases the between row spacing will be at least 4 feet wider than the cultivation equipment to be utilized.

Each tree or shrub row will contain a single species or species similar in growth and size characteristics (unless a change in soils indicates a need for species change). Low growing shrubs will be planted in the outside rows. Tall growing deciduous trees will be planted in the center row or rows if used in plantings of three or more rows. Conifer rows will be planted between the rows of shrubs and deciduous trees. Tree planting will be staggered in adjacent rows.

Avoid planting trees and shrubs where they will interfere with structures and above/below ground utilities.

VISUAL AND NOISE SCREENS

Noise screens shall be at least 65 percent dense, as tall as the noise source, and as close to the noise source as practicable.

The length of the noise screen will be twice as long as the distance from the noise source to the noise receiver.

For high-speed traffic noise, the barrier needs to be 65-100 feet wide. For moderate speed traffic noise, the barrier width can be reduced to 20-25 feet.

Visual screens shall be located as close to the observer as possible. Screen widths will vary with location and species planted.

ODOR SCREENS FOR CONFINED ANIMAL OPERATION

Properly designed windbreak results in a buffer that helps mitigate dust, feather, and ammonia emissions from confined animal operations.

The area of direct impact from tunnel fans is the most critical area for planning since odor, ammonia, dust, and feather loads predominate here.

The distance trees are planted from exhaust fans is critical. Plantings should be installed at a minimum distance of 10 times the fan diameter in feet. This usually corresponds to a minimum of 50 feet. Since severe feather matting is common, planting closer than this will drastically reduce the survival of any plant. Deciduous trees tolerate these extreme conditions better than evergreen trees and should be planted in the first row closest to tunnel ventilation fans.

A minimum of three staggered rows is recommended for the fan impact area.

The inside row (closest to the fans) should be deciduous trees or shrubs. The middle row should be planted with deciduous trees. And the outside row should be planted with evergreen trees.

A minimum of two staggered rows of evergreens is recommended for the areas adjacent to the screens.

All trees planted along the sidewalls should be at least 50 feet from the house. Load out areas should have a minimum of 80 feet.

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Table 1. Wind speed reduction to the lee of windbreaks with different densities.*

Open Wind Speed 20 MPH Deciduous 25-35% Density					
H Distance	**5H**	**10H**	**15H**	**20H**	**30H**
Miles per hour	10	13	16	17	20
% of open wind speed	50	65	80	85	100
Open Wind Speed 20 MPH Conifer 40-60% Density					
H Distance	**5H**	**10H**	**15H**	**20H**	**30H**
Miles per hour	6	10	12	15	19
% of open wind speed	30	50	60	75	95
Open wind Speed 20 MPH Multiple Row 60-80% Density					
H Distance	**5H**	**10H**	**15H**	**20H**	**30H**
Miles per hour	5	7	13	17	19
% of open wind speed	25	35	65	85	95
Open Wind Speed 20 MPH Solid Fence 100% Density (For comparison only)					
H Distance	**5H**	**10H**	**15H**	**20H**	**30H**
Miles per hour	5	14	18	19	20
% of open wind speed	25	70	90	95	100

*Adapted from How Windbreaks Work, University of Nebraska Extension EC 02-1763-X

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