

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD  
WINDBREAK/SHELTERBELT ESTABLISHMENT**

(Ft.)

CODE 380

**DEFINITION**

Windbreaks or shelterbelts are single or multiple rows of trees or shrubs in linear configurations.

**PURPOSE**

- Reduce soil erosion from wind.
- Protect plants from wind related damage.
- Alter the microenvironment for enhancing plant growth.
- Manage snow deposition.
- Provide shelter for structures, animals, and people.
- Enhance wildlife habitat.
- Provide noise screens.
- Provide visual screens.
- Improve air quality by reducing and intercepting air borne particulate matter, chemicals and odors.
- Delineate property and field boundaries.
- Improve irrigation efficiency.
- Increase carbon storage in biomass and soils.
- Reduce energy use

**CONDITIONS WHERE PRACTICE APPLIES**

Apply this practice on any areas where linear plantings of woody plants are desired and suited for controlling wind, noise, snow and as visual screens. Use other tree/shrub practices when wind, noise, snow and visual problems are not concerns.

**CRITERIA**

**General Criteria Applicable to All Purposes**

The location, layout and density of the planting will accomplish the purpose and function intended within a 20-year period. Refer to Windbreak/Shelterbelt Establishment Design Procedures (380DP). For guidance on 20 year heights, species density, species adaptation to specific soils/vegetation zones, and species attributes, refer to Conservation Tree/Shrub Groups (NE FOTG Section II, Windbreak Interpretations. Refer to Windbreak/Shelterbelt Establishment Tree Planting Procedures (380TPP) for preparing site conditions for plant establishment.

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 adapted to the soils, climate and site conditions. Refer to FOTG II, Windbreak Interpretations, Conservation Tree/Shrub Groups, for the selection of tree/shrub species appropriate of each of four vegetative zones in Nebraska.

No plants on the Federal or state noxious weeds list shall be planted.

Spacing between individual plants shall be based on the needed growing space for plant type and species, the accommodation of maintenance equipment, and the desired characteristics of the stem(s), branches and canopy as required for a specific purpose.

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

The length of the windbreak will be sufficient to protect the site including consideration for the "end effect" and changes in wind direction.

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

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

Refer to 380TPP, Windbreak/Shelterbelt Establishment Tree Planting Procedures for further guidance on planting trees and shrubs.

### **Additional Criteria to Reduce Wind Erosion and Protect Growing Plants**

The interval between windbreaks shall be determined using current, approved, wind erosion technology. Interval widths shall not exceed that permitted by the soil loss tolerance (T), or other planned soil loss objective. Calculations shall account for the effects of other practices in the conservation management system.

For wind erosion control, temporary measures will be installed to supplement the windbreak until it is fully functional.

Sites, fields, and plants are protected within an area 10 times the design height (H) on the leeward side and two times the design height (H) on the windward side of the windbreak.

Select species that are taller than the crops being protected.

### **Additional Criteria to Manage Snow Deposition**

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

For snow distribution across a field, the windbreak density (during expected snow-producing months) shall not be less than 25 percent or greater than 50 percent. The interval between barriers will not exceed 20H.

For snow accumulation, the minimum barrier density, during expected snow-producing months, will be 50 percent.

The length of the windbreak will extend beyond the area being protected to allow for end drifts.

Windbreaks will be located so that snow deposition will not pose a health or safety problem, management constraints, or obstruct human, livestock or vehicular traffic.

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

### **Additional Criteria to Provide Shelter for Structures, Livestock and People**

For wind protection, the minimum windbreak/shelterbelt density will be 65 percent during the months of most troublesome wind.

The area to be protected will fall within a leeward distance of 10H.

Drainage of snowmelt from the windbreak shall not flow across the livestock area.

Drainage of livestock waste from the livestock area shall not flow into the windbreak. A diversion, grass waterway or other conservation practice(s) can be used if necessary.

### **Additional Criteria for Noise Screens**

Noise screens shall be at least 65 percent dense during the time of the year when noise is a problem, as tall as, and as close to the noise source as practicable.

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

For high-speed traffic noise, the barrier shall not be less than 65 feet wide. The edge of the tree belt shall be within 50 to 80 feet from the edge of the nearest traffic lane.

For moderate speed traffic noise, the barrier width shall not be less than 20 feet wide. The edge of the tree belt shall be 20 to 50 feet from the edge of the nearest traffic lane.

Species selected will be tolerant to noxious emissions, sand, gravel depositions or salt spray from traffic areas.

For maximum effectiveness, tree-shrub belts shall be tall, dense, and located close to the noise source, rather than close to the area protected.

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Conifer trees and year round moderately dense-to-dense shrubs are most effective where year-round noise screening is desired.

### **Additional Criteria for Visual Screens**

Visual screens shall be located as close to the observer as possible with a density, height and width to sufficiently block the view between the area of concern and the sensitive area.

Evergreen trees and/or shrubs are most effective where year-round screening is desired. A single row of trees is sufficient for this type of planting. The 20-year height must be tall enough to screen the unsightly area.

### **Additional Criteria to Improve Air Quality by Reducing and Intercepting Airborne Particulate Matter, Chemicals and Odors**

The windbreak interval shall be less than or equal to 10h depending on site conditions and related supporting conservation practices.

Windbreak density on the windward side of the problem source, (i.e. particulate, chemical or odor) shall be greater than 50% to reduce the airflow into the source area.

Windbreak density on the leeward side of the problem source, and windward of the area to be protected, shall be greater than 65%.

Select and maintain tree and shrub species with foliar and structural characteristics to optimize interception, adsorption and absorption of airborne chemicals or odors.

### **Additional Criteria for Increasing Carbon Storage in Biomass and Soils**

Maximize width and length of the windbreak to fit the site.

For optimal carbon sequestration, select plants that have higher rates of sequestration in biomass and soils.

Plant and manage the appropriate plant spacing for the site that will maximize above and below ground biomass production

Minimize soil disturbance during establishment and maintenance of the windbreak/shelterbelt.

### **Additional Criteria for Enhancing Wildlife Habitat or Creating Travel Corridors**

Plant species selection shall benefit targeted wildlife species including pollinators.

Design dimensions of the planting shall be adequate for targeted wildlife species.

Plantings shall not border or bisect intact grassland habitats and cause habitat fragmentation.

### **Additional Criteria for Improving Irrigation Efficiency**

For sprinkler irrigation systems, the windbreak shall be taller than the spray height.

The windbreak shall not interfere with the operation of the irrigation system.

### **Additional Criteria to Reduce Energy Use**

Orient the windbreak as close to perpendicular to the troublesome wind as possible

Use proper plant density to meet energy reduction needs.

Use plants with a potential height growth that will be taller than the structure or facility being protected.

## **CONSIDERATIONS**

Consider enhancing aesthetics by using evergreen species or species with features such as showy flowers, brilliant fall foliage, or persistent colorful fruits.

When designing and locating a windbreak or shelterbelt, consider the impact upon the landowner's or public's view of the landscape.

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

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

All plantings should complement natural features.

Tree or shrub rows should be oriented on or near the contour where water erosion is a concern. Where water erosion and/or runoff from melting snow is a hazard, it should be controlled by supporting practices.

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Wildlife and pollinator needs should be considered when selecting or siting tree or shrub species. Species diversity, including use of native species, should be considered.

Species diversity, including use of native species, should be considered to avoid loss of function due to species-specific pests.

Avoid habitat fragmentation of intact grasslands by windbreaks and other tree cover to reduce the negative impacts on grassland nesting birds and other wildlife dependent upon large expanses of contiguous grass habitat.

Consider the invasive potential when selecting plant species.

Increase the effectiveness of windbreaks for odor and chemical control by increasing the amount of foliage available for intercept. Planting of multiple rows with wide spacing within rows offers greater interception potential.

When using trees and shrubs for greenhouse gas reductions, prediction of carbon sequestration rates should be made using current, approved carbon sequestration modeling technology.

A shelterbelt can be used as a travel corridor to connect existing patches of wildlife habitat.

In cropping systems select windbreak and shelterbelt species that minimize adverse affects to crop growth (e.g. shade, allelopathy, competing root systems or root sprouts).

Species of trees or shrubs that may produce commercially valuable products can be included and harvested if the intended function of the shelterbelt is maintained.

Minimize the impact of severe insect and disease problems by including more than one species and selecting resistant varieties.

Trees and shrubs generally cannot tolerate concentrated livestock waste. If necessary, a diversion or other conservation practice shall be used to divert runoff/effluent from the windbreak. If drainage correction is not possible a non-vegetative windbreak may be required.

### PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using the NE-CPA-15, Tree and Shrub Planting Plan job sheet, technical notes, and narrative statements in the conservation plan, or other documentation as needed.

Specifications/practice designs will be based on this practice standard (380), Design Procedures (380DP), and Tree Planting Procedures (380TPP).

As a minimum, specifications will contain the following data per the NE-CPA-15 Tree and Shrub Planting Plan job sheet:

- Operator name, address, phone number
- NRD, county location, type of planting
- Conservation Tree/Shrub Suitability Group and soil name, based on soils on the site
- Area to be planted
- Planned weed control within and between tree/shrub rows
- Planned planting method(s) and date(s)
- The type of fabric mulch to be installed if fabric mulch is being used
- Planned site preparation, including method utilized to eliminate aggressive dense sod-forming grasses
- Planned species to be planted in each row
- Spacing within and between each row planted
- Estimated number of each plant needed
- Actual number of plants planted
- Maps or drawings as needed to show location and site layout
- Who installed the plantings
- Signature and date(s) planted

### 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),

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and repair and upkeep of the practice (maintenance).

Replacement of dead trees or shrubs will be continued until the windbreak/shelterbelt is functional. Refer to 380TPP for additional requirements on replanting.

Supplemental water will be provided as needed.

Thin or prune the windbreak/shelterbelt to maintain its function.

Inspect trees and shrubs periodically and protect from adverse impacts including insects, diseases or competing vegetation. The trees or shrubs will also be protected from fire and damage from livestock and wildlife.

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

### REFERENCES

Bentrup, Gary 2008. Conservation buffers: design guidelines for buffers, corridors, and

greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station.

Brandle, J.R., *et al.* 1988. Windbreak technology. Agric. Ecosyst. Environ. Vol. 22-23.

National Agroforestry Center. 2009. Windbreak Design Clipboard. Lincoln, NE. (NE NRCS for Tech. Note 73)

Tyndall, J.C. and D.C. Wallace. 2011. Windbreaks: A "fresh" tool to mitigate odors from livestock production facilities. USDA, Natl. Agroforestry Center, AF Note 41, Lincoln, NE. <http://www.unl.edu/nac>

University of Nebraska Neb Guides and other references at:

<http://www.ianrpubs.unl.edu/epublic/pages/>