



**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
WINDBREAK/SHELTERBELT ESTABLISHMENT
CODE 380
(FT.)**

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, and visual resources. Use other tree/shrub practices when wind, noise 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 Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS), Tree/Shrub Site Preparation (Code 490), for preparing site conditions for plant establishment.

In multiple row windbreaks using different species for each row can reduce loss from disease, increase windbreak longevity, increase biological diversity, and provide better overall growth form of the windbreak.

Number of rows in a windbreak or shelterbelt:

- A single row of trees or shrubs is adequate if a good stand and moderate density is maintained.
- Two or more rows will be used where two or more rows are needed to meet the desired density.
- Two or more rows may be used when the owner wishes to obtain a level of protection, wildlife benefit, or beautification not provided by minimum one-row designs.

Tree spacing within a windbreak or shelterbelt:

- Within the row, minimum and maximum spacing will be:
 1. Large broad-leaf trees:
 - Single row: 10 to 15 feet
 - Multiple rows: 10 to 20 feet
 2. Small and medium broad-leaf trees and conifers:
 - Single row: 6 to 12 feet
 - Multiple rows: 6 to 15 feet
 3. Shrubs, depending on species:
 - 3 to 8 feet

Note: The spacing within the row and between rows are approximate. It is difficult to plant trees at exact spacings.

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 Wisconsin Forestry Technical Note 4, Tree and Shrub Species for Windbreak.

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.

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

Access lanes or roads should cut through the windbreak at an angle to prevailing winds to prevent funneling of wind. Lanes or roads through single row barriers should be avoided. Locate them 100 to 500 feet from the ends of single row windbreaks to prevent deposition onto the lane or road.

Refer to WI NRCS CPS, Tree/Shrub Establishment (Code 612) 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. For design purposes, the windbreak height will be estimated at 20 years of age.

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.

To reduce hazard of black ice and snow drift, the windward row will be a minimum of 200 feet and a maximum of 300 feet from the centerline of roads. Trees should be planted no closer than 200 feet from corners or intersections in order to allow for traffic visibility.

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 barrier density will be 65 percent during the months of most troublesome wind. The windbreak will be oriented as close as possible to perpendicular to the prevailing 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.

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. For moderate speed traffic noise, the barrier width shall not be less than 20 feet wide.

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

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.

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 percent 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 percent.

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

Plant species selection shall benefit targeted wildlife species including pollinators.

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

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.

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.

Consider the invasive potential when selecting plant species.

Windbreaks for odor and chemical control increase in effectiveness as the amount of foliage available for intercept increases. Multiple-row, wide plantings offer greater interception potential than do smaller plantings.

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).

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using the approved Wisconsin Job Sheet 380.

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).

Replacement of dead trees or shrubs will be continued until the windbreak/shelterbelt is functional.

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.

FEDERAL, TRIBAL, STATE AND LOCAL LAWS

Users of this standard should be aware of potentially applicable federal, tribal, state and local laws, rules, regulations or permit requirements governing cover crops. This standard does not contain the text of federal, tribal, state or local laws.

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.

USDA, NRCS, Wisconsin Forestry Technical Note 4, Trees and Shrubs for Windbreaks and Shelterbelts.

Wisconsin Job Sheet 144, Farmstead Windbreak/ Field Windbreak.

USDA, NRCS, Wisconsin Field Office Technical Guide, Section I, Erosion Prediction-Part II, Estimating Soil Loss From Wind Erosion.

USDA, NRCS, Wisconsin Field Office Technical Guide, Section II, Windbreak and Environmental Planting Interpretations.

USDA, NRCS Wisconsin Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications.

USDA, NRCS National Engineering Handbook (NEH), Part 650, Engineering Field Handbook.

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