



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WINDBREAK-SHELTERBELT ESTABLISHMENT AND RENOVATION

CODE 380

(ft)

DEFINITION

Establishing, enhancing, or renovating windbreaks, also known as shelterbelts, which are single or multiple rows of trees and/or shrubs in linear or curvilinear configurations.

PURPOSE

Use this practice to accomplish one or more of the following purposes:

- Reduce soil erosion from wind
- Enhance plant health and productivity by protecting plants from wind-related damage
- Manage snow distribution to improve moisture utilization by plants
- Manage snow distribution to reduce obstacles, ponding, and flooding that impacts other resources, animals, structures, and humans
- Improve moisture management by reducing transpiration and evaporation losses and improving irrigation efficiency
- Provide shelter from wind, snow, and excessive heat, to protect animals, structures, and humans
- Improve air quality by intercepting airborne particulate matter, chemicals, and odors, and/or by reducing airflow across contaminant or dust sources
- Reduce energy use in heating and cooling buildings, and in relocating snow
- Increase carbon storage in biomass and soils

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all lands except forest land, where windbreak establishment, enhancement, or renovation is needed and desired to achieve one or more practice purposes or to extend the functional life of an existing windbreak.

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, install, enhance, and renovate windbreaks to comply with applicable Federal, State, and local laws and regulations. Locate and design windbreak plantings to achieve functionality for their intended purposes within 20 years from the time of establishment. See the NRCS MI Guidance Document for this practice for design guidance.

Design windbreak dimensions and configurations to address site conditions. When determining H (the estimated 20-year height of the tallest row of trees), adjust estimates based on site productivity. Use species and setback distances that allow for the expected mature windbreak size to mitigate potential negative impacts of shading, visibility along travel routes, snow deposition, or concerns for visual quality. Orient windbreaks as close to perpendicular to the wind direction(s) that causes the resource concern as practical. Design windbreaks of adequate length to protect the site and allow for “end effect” (turbulence effects at the end of a windbreak) and minor changes in predominant wind direction.

Control erosion, runoff, compaction, and displacement during establishment and renovation.

Select woody species that are adapted to soils, climate, anticipated spray drift, and other site conditions. Use the [Conservation Tree/Shrub Suitability Guide](#) (CTSG) in Section II of the Michigan NRCS Field Office Technical Guide (FOTG) and other appropriate reference material to assist with tree/shrub selection. Do not use species that are on Federal or State invasive species or noxious weed lists. See [Invasive Species Guidance](#) in Section II of the FOTG. Select only viable, high-quality, and adapted plant materials. Select planting stock that meets the [American Nursery Stock Standard](#) (AmericanHort, 2014).

Space individual plants based on the growing area needed by each species, with accommodation for maintenance equipment and for the desired configuration of the stems, branches, and canopy to achieve windbreak purposes.

Do not plant trees or shrubs where they will interfere with above- or below-ground structures, utilities, property lines, fences, irrigation or moisture management systems, or desired drains. Ensure that any removal of products, such as high value trees, medicinal herbs, nuts, fruits, etc., does not compromise the conservation purpose.

Select appropriate planting dates and handling and planting techniques to best ensure that planted materials have an acceptable rate of survival.

Evaluate each site to determine if mulching, supplemental watering or other cultural treatments will be needed to ensure adequate survival and growth. Use the following NRCS Conservation Practice Standards (CPSs) as needed to establish or renovate windbreaks:

- Cover Crop (Code 340) to establish herbaceous cover between windbreak rows
- Herbaceous Weed Treatment (Code 315) for follow-up weed control after establishment
- Irrigation System, Microirrigation (Code 441) for supplemental water
- Mulching (Code 484) for organic or nonorganic mulch, fabric, etc.
- Tree/Shrub Site Preparation (Code 490) for preparing the site prior to plant establishment

Additional Criteria to Reduce Wind Erosion and Protect Growing Plants

Determine the appropriate interval between windbreaks using current soil erosion prediction technology, i.e., Wind Erosion Prediction System (WEPS), to minimize wind erosion. Interval widths must not exceed that permitted by the soil loss tolerance (T) or other planned soil loss objective. Plan windbreak intervals to account for a protected zone of 10H on the leeward side and 2H on the windward side, and to account for the effects of other practices used in the conservation management system.

Install temporary measures to supplement the windbreak until it is fully functional, as needed. Design windbreaks with adequate height to protect the desired area. Select species for planting that are taller than the height of the crop.

Additional Criteria to Manage Snow Deposition

Locate windbreaks so that snow deposition will not pose a health or safety problem, management constraint, or obstruct human, animal, or vehicular traffic. For snow accumulation, design the windbreak density during expected snow-producing months to be at least 50 percent. For snow distribution, design

the windbreak density (during expected snow-producing months) to be between 25% and 50%, and with an interval between windbreaks not to exceed 20H.

Where it is desirable for wind to blow snow off road surfaces and limit ice formation, design windbreaks using greater setback distances and allow for maximum mature windbreak height as well as 20-year height.

Additional Criteria to Provide Shelter for Animals, Structures, and Humans

Establish or renovate windbreaks to provide shade or reduce wind or snow impacts to animals, structures, or humans; or to reduce energy use. Where feasible, plant native species that benefit wildlife, including pollinators and natural enemies of crop pests.

To protect animals from cold and wind, design windbreak density to be at least 65 percent during the months when the wind is most responsible for the resource concern. Use plants with a potential height growth taller than the structure or facility being protected. Design and maintain shade-producing windbreaks at a low density as needed to allow for air movement.

Prevent snowmelt drainage from a windbreak from flowing across an area of animal confinement. Prevent drainage of animal waste into a windbreak.

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

Design windbreak intervals to be less than or equal to 10H, modified as needed based on site conditions and related supporting conservation practices. Design windbreak density on the windward side of the problem source (i.e., particulate, chemical, or odor) to be greater than 50 percent to reduce airflow into the source area.

Locate odor-protecting windbreaks of 50 to 65 percent density on the leeward side of the problem source, and windward side of the area that needs protection, to decrease wind speed, increase odor particle deposition, and create wind turbulence that disperses and dilutes odor particles.

Use tree and shrub species with foliar and structural characteristics that optimize interception, adsorption, and absorption of airborne particles, chemicals, or odors, with a preference for coniferous evergreens.

Additional Criteria to Reduce Energy Use in Structures

Design windbreaks to address heating and cooling needs of structures as needed for the local climate. Use plants with a potential height growth taller than the structure or facility that needs protection and with a plant density that meets energy reduction needs. To reduce heat loss in structures, locate the windbreak on the windward side of the structure, no farther than 5H from the structure, and with density of at least 50 percent.

In areas where snow drifting is a common problem, ensure that windbreak setbacks are adequate to limit snow deposition near structures or in other areas that will require mechanical snow removal.

Ensure that summer windbreak densities are low enough that they do not stifle cooling breezes. Note the direction of seasonal winds and design accordingly.

Additional Criteria for Carbon Capture and Storage

Plant windbreaks with a larger footprint to increase carbon capture and storage in biomass and soils. Adjust plant spacing and species selection to increase above- and below-ground productivity for increased carbon capture and storage where practical.

Maintain adequate site fertility. Manage without tillage, where possible, to reduce impacts on soil organic matter. Limit the use of petroleum-based herbicides and fertilizers.

Additional Criteria for Windbreak Renovation

Renovate windbreaks by adjusting the design, width, length, species composition, and density to achieve functionality for the intended purposes within 20 years. Protect desirable vegetation as well as soil and site conditions during renovation.

Thin windbreaks as needed to reduce plant competition, alter windbreak density, remove dead, injured or diseased vegetation, or provide access for maintenance. Remove entire or partial windbreak rows to release trees/shrubs in adjacent rows. Cut trees/shrubs that regrow from their base, i.e., coppicing, close to the ground when vigorous regrowth is desired. Use NRCS CPS Tree/Shrub Pruning (Code 660) for branch or root pruning.

Retain vegetative residues onsite except where fire hazard or threats from diseases and insect pests are of concern or where it negatively impacts prescribed burning or other planned management. Use NRCS CPS Woody Residue Treatment (Code 384) to treat woody debris as necessary to assure that it does not present an unacceptable fire, safety, environmental, or pest hazard. When woody residue or other debris requires onsite burning, use NRCS CPS Prescribed Burning (Code 338).

Add rows of trees or shrubs adjacent to or within an existing windbreak to increase windbreak density as needed to achieve the purpose. Plant individual trees or shrubs to fill gaps or replace declining plants. Before adding trees or shrubs, evaluate existing growing space, shade level, and root competition to determine that conditions are acceptable for the growth of new plantings.

Where herbicide application will occur, evaluate and interpret risks using the Windows Pesticide Screening Tool (WIN-PST) or other approved tools or guides, or use NRCS CPS Pest Management Conservation System (Code 595).

CONSIDERATIONS**General Considerations**

Windbreaks can help USDA certified-organic and transitioning-to-organic producers meet National Organic Program requirements for suitable buffers or barriers between certified organic production areas and nonorganic production areas.

Orient tree or shrub rows on or near the contour where water erosion is a concern.

Considerations for Species Selection

Consider including trees and shrubs that produce edible fruits and nuts. Use native species if possible.

In cropping systems, select windbreak species that minimize adverse effects on crop growth (e.g., shade, allelopathy, competing root systems, or root sprouts). Avoid using plants that may be alternate hosts to undesirable pests. Consider increasing species diversity to avoid loss of function due to species-specific pests. Consider wildlife and pollinator needs when selecting species to add or remove.

Use deciduous trees on south and west sides of structures to reduce summer energy use. Use conifer windbreaks to reduce impacts of prevailing winter winds and reduce energy use.

Considerations for Windbreak Design

Plan and design windbreaks to be visually pleasing and to complement natural landscape features. Windbreaks are not usually fully functional immediately after installation. Plan other practices as appropriate to control wind erosion in adjacent fields until a windbreak is fully functional.

Use one or more “legs” (i.e., windbreak extensions oriented at right angles to the main windbreak), where practical, to provide protection from changing winds and to increase the area of the protected zone.

Windbreaks established for odor and chemical drift reduction are more effective as the amount of foliage surface area increases. Wide, multiple-row plantings offer greater interception potential than smaller plantings.

Closer spacings will provide protection in the shortest time. However, plantings with narrow spacing should be designed with a thinning recommended to achieve the ultimate spacing.

In multiple-row plantings, the species with the shortest 20-year height and slower-growing species should be planted in outer rows so they are not overtopped by fast-growing and taller species.

Considerations for Managing Snow

Consider additional actions for situations where a windbreak alone does not provide enough snow storage (e.g., add windbreak rows, herbaceous wind barriers, constructed or living snow fences, retain standing crop residues within the fetch (storage) area). Retain standing crop residues to enhance the effectiveness of windbreaks in uniformly distributing snow across a field.

To control end drifts, extend the length of the windbreak beyond the protected area, add supplemental windbreak legs, use greater setback distances, or use temporary or herbaceous wind barriers.

Considerations for Wildlife Habitat

Design windbreak dimensions, density, and species composition to provide food and shelter for desired wildlife species. Locate windbreaks where they can serve as wildlife travel corridors by connecting existing patches of habitat. Consider windbreak proximity to roads and potential conflicts between wildlife and vehicles.

Address pollinator and beneficial organism needs when selecting or siting tree or shrub species and when planning windbreak management. Ground-dwelling pollinators may find habitat in an untilled area within the windbreak. Windbreaks may provide habitat for species that pollinate or consume pests in nearby crops. Early-blooming trees can provide nectar sources for pollinators and pest predators in the spring before herbaceous sources are available.

Consider adding plantings of suitable, noncompetitive forbs and legumes that bloom at times when trees are not flowering; this may benefit a greater diversity of native pollinators and natural enemies of crop pests by providing additional nectar and pollen sources.

Considerations for Windbreak Renovation

Renovation may be accomplished in multiple phases to minimize the time of reduced functionality.

Where insect pests and plant diseases are not of concern, treat woody debris by mulching or chipping to increase soil organic matter and reduce herbaceous weed competition. Debris and other vegetation requiring removal during renovation could become biofuel for energy generation. Consider performing a life cycle analysis to determine whether there is a net energy gain after transport and processing.

PLANS AND SPECIFICATIONS

Prepare specifications for windbreak establishment or renovation in accordance with this standard for each site and purpose. Use Implementation Requirements or other acceptable documentation. At a minimum, include—

- Purpose of the Windbreak/Shelterbelt
- Relevant wind direction(s)
- Planting or renovation dates
- Dimensions and configuration of plantings, including windbreak length, design height (H), design density, width, number of trees/shrubs needed, number of windbreak rows and the spacing between and within rows
- Species, type and size of plant materials to be used
- Planting or renovation methods and equipment to be used
- Sequence of planting, if applicable
- Fertilizer and weed control needs
- Plant protection needs
- Plan map showing areas planned for windbreak establishment or renovation, areas impacted by the windbreak, relevant wind direction(s), and locations of known features, structures, and utilities that impact practice design or function
- Soils map with applicable soils descriptions, interpretations, and ecological site information
- Required survival density
- Supporting practices needed for site preparation, post-planting weed control, moisture management, etc.
- Contingency plans to achieve project goals in case of drought, insect/disease impacts, undesired plant invasions, animal pressure, or other situations that may limit vegetation establishment
- Operation and Maintenance requirements

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan and review it with the landowner or operator prior to practice installation. The O&M plan ensures the practice will function as intended throughout its expected life. The plan will include normal repetitive activities that occur during use of the practice (operation), and repair and upkeep (maintenance). At a minimum, include—

- Inspect the site at least semi-annually during the first year after practice installation, at least annually after the first year, and after any major storm event or other disturbance, to identify needs for repair and maintenance. Look for the following concerns during inspections and take corrective actions as needed:

- Adverse impacts to trees/shrubs by pests, competing vegetation, fire, livestock, non-functioning tree shelters and weed barriers, etc.
- Presence of invasive species
- Storm damage
- Damage by trespass
- Erosion, compaction, and other soil and water quality concerns
- Maintain protection for trees and shrubs during establishment, and remove protective structures (e.g., tube shelters, cages) when plants are large enough to withstand environmental stressors.
- Monitor tree or shrub establishment or renovation and replacing dead trees or shrubs as needed until the windbreak is functional.
- Control access by vehicles and/or equipment during and after tree/shrub establishment to protect new plants and minimize erosion, compaction, and other site impacts.
- Provide supplemental water if needed during the establishment period.
- Manage competing vegetation during establishment.
- Thin or prune the windbreak to remove dead, injured, or diseased wood and to maintain windbreak function. See CPS Tree/Shrub Pruning (Code 660).
- Apply maintenance practices and activities at times that minimize wildlife disturbance during the reproductive period for desired species, where wildlife habitat is a consideration.
- Apply nutrients as needed to maintain plant vigor following approved fertilizer recommendations.

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