

Windbreak/Shelterbelt Establishment (Ft.) 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 20 years of age for the given site.

Species must be suitable and adapted to the soils, climate and purpose. Refer to the Michigan NRCS Field Office Technical Guide Section II-N for a detailed listing of species suited to the soils at the site. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological and human health impacts that invasive species may

cause. If native plant materials are not adaptable or not proven effective for the planned use, then non-invasive species may be used. Refer to the Michigan Field Office Technical Guide, Section I, Invasive Plant Species, for plant materials identified as invasive species.

Site preparation shall be sufficient for establishment and growth of selected species and appropriate for the site.

Only viable, high quality, and adapted planting stock will be used. See Tables 3 and 4 for species selection.

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

The planting will be protected from adverse impacts such as livestock and wildlife 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 shall be provided for plant establishment and growth when 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 shall be 10 times the design height (H). See Section 1, Wind Erosion Prediction, of the NRCS Field Office Technical Guide for current calculation methods.

For wind erosion control, the optimum windbreak density will exceed 40%. This can be achieved by using any of the following options:

- a. A single row windbreak consisting of a dense, non-deciduous conifer such as: Spruce, Eastern Red Cedar, Hemlock, Northern White Cedar, or other dense conifer. Where height is a limitation

(power lines and center pivot irrigation systems), 2 rows of shrubs may be substituted for the conifers.

- b. A three-row windbreak consisting of a shrub species, any conifer species not applicable in “a” and a deciduous tree species.
- c. A four-row windbreak consisting of 2 rows of shrub species and 2 rows of deciduous tree species.

Select species on basis of site requirements, disease and pest problems, and crops to be protected. Use Tables 1 and 2 for recommended spacing.

The wind erosion control system should consider temporary measures including residue management, crop rotation, and cover crops to supplement the windbreak until it is fully functional.

Additional Criteria to Manage Snow (Snowbreak)

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

For snow distribution, the optimum snowbreak density is 35 percent and the interval between snowbreaks shall not exceed 20H. This density can be achieved by planting a single row of deciduous trees at the spacing recommended in Tables 1 and 2.

For snow accumulation, the optimum snowbreak density will be 50 percent or more. This can be achieved by planting a minimum of 2 rows of dense, non-deciduous conifers such as Eastern Red Cedar, Northern White Cedar, Spruce, or a minimum of 2 rows of deciduous trees and 2 rows of shrubs at the spacing recommended in Tables 1 and 2. The windward row will be at least 75 feet distant from the area to be protected and will extend 85 feet in either direction perpendicular from the area to be protected.

Shrub snowbreaks consisting of at least two rows planted at the recommended spacing in Tables 1 and 2 will achieve at least a 50% density. The windward row shall be at least 35 feet distant to the area to be protected and shall extend 50 feet in either direction perpendicular to the area being protected.

Snowbreaks established for snow protection along roads will be located so that visibility and snow deposition will not adversely impact the road or intersection. Local regulations concerning planting of trees and shrubs for snow protection along roads will be observed.

Additional Criteria to Provide Shelter for Structures, Livestock, and for Wildlife Habitat

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

For wind protection, the optimum barrier density will exceed 65 percent and the area to be protected will fall within 10H of the design height. This minimum can be achieved by using any of the following options:

- a. A three-row windbreak consisting of 3 rows of non-deciduous conifers.
- b. A three-row windbreak consisting of 2 rows of any non-deciduous conifer species and 1 row of shrubs.
- c. Any of the above combinations where 1 row of non-deciduous conifers may be substituted with 2 rows of deciduous trees and a row of shrubs.

Plantings will be placed at least 75 feet from structures or feedbunks to avoid snow accumulation and reduce turbulence. The ends of the windbreak will extend 85 feet beyond the structure or livestock area to prevent the drift, which forms at the end of the windbreak from interfering with farm operations.

If sufficient space is available, a dense single or double row of shrubs or vegetative barriers such as wheatgrass or big bluestem may be planted 40 to 100 feet windward of the windbreak may be planted to create a snow trap enhance wildlife habitat. An effective snow trap will: a) reduce snow deposition and potential snow damage of plants within the windbreak; b) allow placement of the windbreak closer to the area being protected; and c) reduce the minimum number of rows in the windbreak by one.

Shrub windbreaks containing multiple rows may be enhanced for wildlife by staggering rows and spacing

plants up to 8 feet within rows to enhance fruit production.

In multiple-row plantings containing more than 3 rows, the leeward rows may be planted in groups or segments containing 5 or more plants of one species in a series to enhance wildlife values.

Additional Criteria for Screens

Noise screens shall have a density of 65% or more. This can be achieved with a minimum of 3 rows of non-deciduous conifers or 2 rows of non-deciduous conifers and a dense shrub row. The screen shall be as tall as, and as close to, the noise source as practicable.

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

CONSIDERATIONS

Spacing between windbreaks and rows of windbreaks may be adjusted, within limits of the criteria above, to accommodate widths of equipment.

Multiple-row plantings should contain a variety of species to lessen the chance of loss due to species-specific insects or disease.

Alternating species, either trees or shrubs, within the same row is only recommended if the species used have similar growth habits and their projected height (H) at 20 years of age is within 10%.

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.

Older-age and medium to larger size planting stock, including bare rooted, transplants, balled and burlap and container grown stock are recommended in single row and minimum design windbreaks. Death loss is more critical in these designs and larger and older planting stock may provide an advantage in survival rates.

Refer to Michigan NRCS Standard 612 –Tree/Shrub Establishment for size requirements and care and handling of planting stock.

Refer to Michigan NRCS Conservation Design Sheet 612-Weed Control for Tree/Shrub Establishment for guidelines on weed and pest control.

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.

Windbreak Density and Spacing

Windbreak design density will vary based on the planned function of the barrier. Plant densities for trees and shrubs will depend on their potential height at 20 years of age. Heights may be estimated based on: 1) performance of the individual species (or comparable species) in nearby areas on similar sites, or 2) predetermined and documented heights using Section II-N of the Michigan Field Office Technical Guide, Windbreak Suitability Groups.

Total windbreak density is a function of the number of rows in the planting, the species and spacing used, and the season (leaf-on versus leaf-off)

1. Spacing Between Rows

Spacing between adjacent rows can vary or be uniform. If plantings are to be cultivated, plan the row spacing wide enough for maintenance equipment to operate freely between rows. Usually this requires

about 4 feet more than the width of cultivation equipment.

Table 1. Spacing Between Rows

Plant Types/Heights	Minimum Spacing Between Rows*
Between shrubs and small trees from 10 to 25 feet in height	12 ft.
Between small trees less than 25 ft. in height	12 ft.
Between small and tall trees greater than 25 ft. in height	16 ft.
Between tall trees greater than 25 feet in height	16 ft.
Between any wide-crowned species and conifers	20 ft.
Between faster growing species and conifers	20 ft.

Maximum row spacings will depend on site conditions and planned barrier function but will not exceed 20 feet. Exception to these spacings includes the use of vegetation as a snow catch and where the landowner plans to remove every other row before crowding starts.

2. Spacing Within Rows

Table 2. Spacing Within Rows

Plant Types/Heights	Minimum Plant-to-Plant Spacing in feet*
Shrubs less than 10 feet in height	3-6
Shrubs and trees from 10 to 25 feet in height	5-10
Trees greater than 25 feet in height	8-16

Where plantings exceed the minimum design criteria, through the use of additional rows, plant-to-plant spacings up to 20 feet may be planned for appropriate species.

Closer spacings result in providing protection in the shortest period of time. Plantings with narrow spacings can be designed with a thinning recommended to achieve the ultimate spacing.

*Note: Above recommended spacings are minimums. Productivity of plantings established for wildlife habitat purposes may be improved by increasing spacing in row and between row by 25% or more if needed.

3. Site Preparation

Site preparation shall be sufficient for establishment and growth of selected species and appropriate for the site. Necessary site preparation shall be done at a time and manner to insure survival and growth of planted species. Trees or shrubs should not be planted in the fall on heavier-textured soils that may be subject to frost heave action.

Planting sites shall be properly prepared based on the soil type and vegetative conditions listed below. Avoid sites that have had recent applications of pesticides harmful to woody species. If pesticides are used, apply only when needed and handle and dispose of properly according to federal, state and local regulations. Follow label directions and precautions on containers.

Hand cut or herbicide all competing woody vegetation and repeat treatment until resprouting does not occur.

On sites where chemical treatment of competing vegetation is not desired or is impractical, follow guidelines for weed control in Michigan NRCS Conservation Design Sheet 612-Weed Control for Tree/Shrub Establishment.

Sod and Alfalfa sites:

- Band spray a 36-inch wide strip with a non-selective herbicide one season (preferably fall) before planting in the residue. Heavier textured

soils with excessive compaction or plow pans may need to be ripped with a subsoiler to break pan in each row prior to planting. Follow-up herbicide treatment may be necessary for the next 2 years until planting is established.

- Kill sod by treating entire area to be planted with a non-selective herbicide. These herbicides are most effective when used one season prior to planting. Plant stock into the killed residue.

Small Grain or Row Crop Sites:

- If the site has been used to grow row crops recently check to make sure no residual chemicals harmful to woody plants are present. Do not till the soil prior to planting. Apply herbicide as needed to control any grass or weeds present by band spraying 36-inch wide strips or spraying entire area to be planted. If mechanical planting machine is used remove scalper and plant in residue or set scalper to a depth of 2 inches or less. If hand planting, plant directly into residue. If a plow pan or other rooting restriction is present in the subsoil perform a deep ripping operation in the fall. A fall-seeded cover crop of oats may be used where needed to control erosion.
- Do not scalp with a machine planter on steep slopes unless it is across or on contour of the slope. A cover crop of oats between the rows may be established, where needed, to control erosion and sediment deposition on planted stock.

4. Mulch Materials

- Geotextile fabric, tree mats and appropriate organic mulch materials may be used for weed control and moisture conservation on all sites.
- Acceptable mulches, fabric, or mat materials must allow for water infiltration and air movement. Fabric mats will be a minimum of 3 feet by 3 feet in size and properly secured. Manufactured fabrics and tree mats must have a serviceable life span of at least 36 months.

- When organic mulches are used the material shall be placed in a minimum 4-inch deep layer and at least a 2-foot wide radius around the plant. Organic mulches should be kept at least 6 inches away from the main stem of the trees and shrubs to discourage feeding and damage by mice and rodents.

5. Planting

- Plantings using bare rooted stock and non-rooted cuttings should be made in the spring as soon as possible after the frost leaves the ground but no later than May 20.
- Containerized and balled and burlap stock may be planted in frost-free ground provided soil moisture is adequate.
- To assure proper alignment of row and spacing, the windbreak should be staked or laid out prior to planting.
- Supplemental watering shall be provided for plant establishment and growth when natural precipitation is too low during the establishment period.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specification sheets, job sheets, and narrative statements in the conservation plan or other acceptable documentation. See NRCS National Job Sheet—380 Windbreak and Shelterbelt Establishment.

These documents are to specify the purpose, location and planting layout as well as the species to be planted by row number, site preparation requirements, planting date, planting method, spacing in row and between rows. Requirements post-planting weed control and operation and maintenance of the practice shall be incorporated into the site specifications.

OPERATION AND MAINTENANCE

The following practices shall be carried out to ensure 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 is functional.

Vegetative competition will be checked semi-annually and controlled as needed.

Thin the windbreak as needed to maintain its function.

Damaging pests will be monitored and controlled. Repellents, poisons, tubing, netting and cages of various kinds may be needed to control rodents and animal damage.

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose.

Harmful pests present on the site shall be controlled or eliminated as necessary.

The windbreak will be inspected at least semi-annually, protected and restored as needed from adverse impacts such as excessive traffic, pest infestations, pesticide use on adjacent lands, livestock use and fire.

As applicable, control of wind or concentrated flow erosion shall be continued in the area up-wind or up-gradient of the windbreak to maintain its function. Maintain central stems on trees by pruning to eliminate forks and multiple leaders. See Michigan NRCS Standard #660a – Tree/Shrub Pruning.

Following severe storms, check for evidence of sediment deposits, erosion or concentrated flow channels. Prompt corrective action needs to be taken to stop erosion.

REFERENCES

Baldwin, C.S., and Johnston, E.F. Windbreaks on the Farm, Ridgetown College of Agricultural Technology, Ontario Ministry of Agricultural Technology, Ridgetown, Ontario. Regional Forester, Ontario Ministry of Natural Resources, London, Ontario.

MN Inter-Agency Living Snowfence Task Force, 1997. Proceedings from Living Snowfence Symposium, Alexandria, MN.

Barnes, B.V. and Wagner, W.H. Jr., 1996, Michigan Trees, The University of Michigan Press, Ann Arbor, MI.

Brandle, J. and Nickerson, H., Windbreaks for Snow Management, University of NE, Lincoln, NE.

Shaw, D.L., 1991. Living Snow Fences: Protection That Just Keeps Growing, Colorado State University, Fort Collins, CO.

USDA, NRCS, Windbreaks for Conservation, 1997. Agriculture Information Bulletin 339.

USDA, NRCS, Windbreak Technology, 1997. NEDC Training Course Handbook, Ft. Worth, TX.

N.E. Scholten, H.S., 1989. Field Windbreaks. University of MN. NR-FO-0824, St. Paul, MN.

Table 3 – Suitability of Tree Species for Windbreaks

Tree Species	Mature Height (ft)	Crown Form	Rooting Habit	Drought Tolerance	Windbreak Suitability	Wildlife Suitability
Ash, Green*	52	Elliptical	Shallow	E	E	F
Ash, White*	78	Elliptical	Shallow	E	E	F
'Imperial' Carolina Poplar	80	Ovoid	Shallow	G	E	F
Honeylocust	75	Spreading	Shallow	E	F	G
Maple, Sugar*	97	Rounded	Shallow	F	G	F
Maple, Silver*	78	Rounded	Shallow	F	F	F
Maple, Red*	68	Rounded	Shallow	G	F	F
Willow, Black*	49	Rounded	Shallow	P	G	P
Willow, Golden	35	Spreading	Shallow	P	F	F
'Roselow' Sargent Crab	20	Rounded	Shallow	G	G	E
Hawthorn*	20	Rounded	Shallow	E	G	E
Oak, White*	81	Spreading	Deep	G	F	E
Oak, Red*	97	Rounded	Deep	F	F	G
Oak, Bur*	80	Rounded	Deep	E	F	E
Eastern Red Cedar*	48	Columnar	Deep	E	E	G
Eastern Hemlock	90	Conical	Shallow	P	E	F
Spruce, White*	80	Conical	Mod.Deep	F	E	G
Spruce, Norway	81	Conical	Mod.Deep	P	E	G
'Affinity' Northern White Cedar	48	Columnar	Shallow	P	E	G
Pine, Red*	97	Ovoid	Mod.Deep	E	P	F
Pine, White*	97	Spreading	Mod.Deep	G	F	G

E-Excellent, G-Good, F-Fair, P-Poor * Denotes Species Native to Michigan

Table 4 – Suitability of Shrub Species for Windbreaks

Shrub Species	Mature Height (ft)	Growth Form	Rooting Habit	Drought Tolerance	Windbreak Suitability	Wildlife Suitability
Dogwood, Gray*	13	Rounded, Dense	Shallow	E	G	G
Michigan Holly*	16	Rounded, Dense	Shallow	P	F	G
'Indigo' Silky Dogwood*	9	Spreading, Erect	Shallow,	P	F	G
Chokeberry*	6	Open, Rounded	Shallow	P	F	F
Common Elderberry*	12	Rounded, irregular	Shallow, Fibrous	P	P	E
Sumac, Smooth*	20	Dense, flat-top	Shallow, spreading	E	G	G
American Native Plum*	8	Open	Shallow	E	G	E
American Hazelnut*	12	Rounded, Dense	Deep, fibrous	E	G	E
'Late' Lilac	10	Rounded, Dense	Deep, fibrous	E	E	P
'Leelanau' Highbush Cranberry*	13	Rounded	Shallow	P	G	E
Mapleleaf Viburnum*	7	Rounded, Dense	Shallow	G	G	G
'Ruby' Red-osier Dogwood*	9	Spreading, Erect	Shallow	P	G	G
Nannyberry*	20	Rounded, Irregular	Shallow	P	P	E

E–Excellent, G-Good, F-Fair, P-Poor *Denotes Species Native to Michigan