

Windbreaks that Work!

Introduction

As any woodland owner knows, growing trees is gratifying. But tree growers must be patient. This is especially true in planting windbreaks. It takes awhile to establish a good windbreak, but you will find the benefits well worth the investment.



What is a windbreak?

A windbreak is a tall, dense, continuous wall of vegetation. The height determines how far wind protection extends, and the density determines the degree of protection.

The general rule is that a windbreak will reduce wind to a distance 10 times its height

and reduce wind speed 70 to 80 percent immediately inside the barrier. There are two kinds of windbreaks—field windbreaks and farmstead windbreaks.

Field Windbreaks

The primary purpose of a field windbreak is to control soil erosion, conserve soil and plant moisture by lowering evaporation rates, and prevent crop damage and loss caused by wind. Field windbreaks are one of the most important conservation practices in areas with relatively flat landscapes and light sandy or organic soils. Field windbreaks commonly have only 1–3 rows of plants due to space limitations but will protect the soil a distance of up to 10 times the height of the trees. With a field windbreak, not only will you save valuable topsoil, you will likely see an increase in crop yield in the area protected.

Farmstead Windbreaks

Farmstead windbreaks provide wind protection for the home, farm buildings, feed lots, and livestock enclosures. The coldest and most damaging winds come from the north and west. You will want to orient your windbreak perpendicular to the wind, on the north and west sides of your home or farmstead.

Advantages of Windbreaks

Windbreaks block a driving wind so that working outside becomes more comfortable in summer and in winter. A good windbreak can reduce home heating costs 10 to 15 percent. Building maintenance costs are reduced, too, as a windbreak lessens the sandblasting effects of wind on house paint. A windbreak is also a sound barrier, since a tall dense windbreak will dull the noise of traffic, machinery, and animals.

Shrubs and trees attract wildlife, are pleasant to look at, and add variety to the landscape. Windbreaks provide a cool escape in summer, a shelter in winter, and as a living snow fence will keep the snowdrifts off your driveway. All in all, a windbreak is a valuable asset to any property and a sound investment.

Getting Started

Soils

Most of the tree and shrub species available today are suited for well-drained, loamy soils for best development and growth. If you have shallow soils (6" or less to bedrock), sandy soils with very low fertility, or poorly drained soils, contact the local DNR forester or Natural Resources Conservation Service (NRCS) for appropriate species information.

Plan for Growth

As your windbreak grows, the taller trees can create hazards if they are too close to the road. Plantings must be at least 30 feet from the edge of a roadway to prevent winter icing in shady spots and to prevent obscuring motorists vision. **A windbreak that will be north or west of a building or road must be planted at least 65 feet from the edge to eliminate snow drifting (Figure 1).**

Watch out for overhead utility lines. Trees and tall shrubs need to be at least 20 feet from utility lines to allow maintenance vehicles to pass and to prevent branches from interfering with lines. Remember not to plant over the easement on underground utilities.

Designing Your Windbreak

A standard farmstead windbreak has at least three rows: the outside or windward row; one or more interior rows; and the inside or leeward row. Four to six rows provide greater protection, but even one or two rows are beneficial.

The standard DNR windbreak packet contains 200 spruce and 100 white or red pine—enough stock to plant a 3-row windbreak that is 800 feet long. The ideal planting design for your windbreak packet is illustrated in Figure 1. Plan on leaving 10–15 feet between rows so you will have room to get in with mowing equipment long into the life of your windbreak. Distance required between plants within a row varies by species (Table 1). To offer wind protection

earlier in the life of the planting, the second row should be offset (staggered in spacing) from the plants in the first and third rows (Figure 1).

For the windward and leeward rows, plant a shade-tolerant conifer that won't lose its lower limbs as it matures. White spruce is a good choice because it will still provide a barrier near the ground even as it grows taller. For the interior row, use a tree species that will add height, so choose something at least as tall as the outside row. White pine, red pine, or green ash are good choices. Refer to Tables 1 and 2 for additional information on recommended species and spacing for your windbreak planting.

Windbreaks for Wildlife

Many windbreaks would be considered complete with three rows, however the addition of a fourth and fifth row using small trees and shrubs substantially increases the wildlife value of a windbreak (Figure 2). Adding small trees and shrubs provides ground level shelter, seasonal food, and more diverse nesting habitat. By increasing the width of the windbreak, you also increase the nest density and nest success of wildlife species living in the windbreak. All of these things mean you will have more opportunity to view wildlife using your windbreak.

Adding 1–2 rows of shrubs 50 feet from the windward side of the windbreak will act as a trap to catch snow before it gets to the main body of the windbreak. By trapping snow before it gets to the windbreak, you increase the winter cover value of the windbreak and reduce tree damage from heavy snowloading.

Generally the location of a windbreak is determined by factors other than potential wildlife benefits. There are, however, some locations that are more beneficial for wildlife. Placement of the windbreak on the north side of row crop fields that will not be fall-plowed will increase the winter food value of such stubble

by reducing the likelihood of the stubble being snow-covered. Also, tying the windbreak to existing permanent cover such as woody draws or woodlots will improve its usefulness to wildlife by allowing the windbreak to serve as a travel lane between cover types.

There can be instances though where establishing a windbreak would actually be detrimental to wildlife. For example, there are

some areas in the Central Sands region of the state where there are still healthy populations of prairie chickens that require large open areas. A windbreak of shrubs would be a better choice in these areas than tall conifers. Likewise, large open grassland areas would be more valuable to wildlife if left unplanted.

Consult with your local DNR wildlife manager for recommendations.

Table 1. Recommended species and spacing for windbreak plantings.

Shrubs —space plants 4 feet apart in rows and 6 feet apart between rows	<i>Dogwoods</i>	<i>American Highbush Cranberry</i>	<i>American Hazelnut</i>
	<i>Ninebark</i>		
Small Trees —space plants 8 feet apart in rows and 10 feet apart between rows	<i>Wild Plum</i>	<i>Hawthorn</i>	
Conifers —space 8 feet apart in rows and 10–15 feet apart between rows	<i>White Pine</i>	<i>White Spruce</i>	<i>White Cedar</i> <i>Red Pine</i>
Hardwoods —space 10 feet apart in rows and 10–15 feet apart between rows	<i>Green Ash</i>	<i>Red Oak</i>	

Table 2. Recommended species for each row in windbreak planting.

Windward Row (Row 1)	<i>White Cedar</i>	<i>White Spruce</i>	<i>Dogwoods</i>	<i>American Hazelnut</i>
	<i>Ninebark</i>	<i>Wild Plum</i>	<i>American Highbush Cranberry</i>	
Interior Row (Row 2)	<i>White Pine</i>	<i>Red Pine (northern 2/3 of state only)</i>	<i>Green Ash</i>	
	<i>Red Oak</i>			
Leeward Rows (Rows 3, 4, and 5)	<i>White Cedar</i>	<i>White Spruce</i>	<i>Dogwoods</i>	<i>American Hazelnut</i>
	<i>Wild Plum</i>	<i>Hawthorn</i>	<i>American Highbush Cranberry</i>	
	<i>Ninebark</i>			
Snow Trap (optional)	<i>Dogwood</i>	<i>Ninebark</i>	<i>American Hazelnut</i>	

Figure 1

Typical windbreak layout in relationship to wind direction and farmstead.

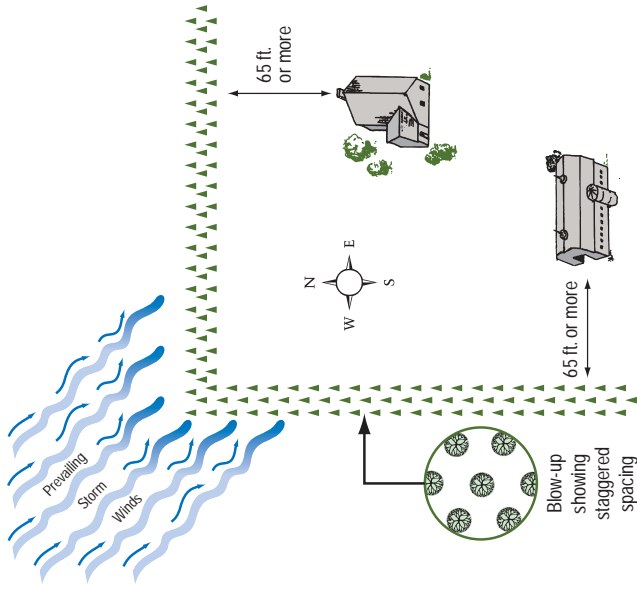
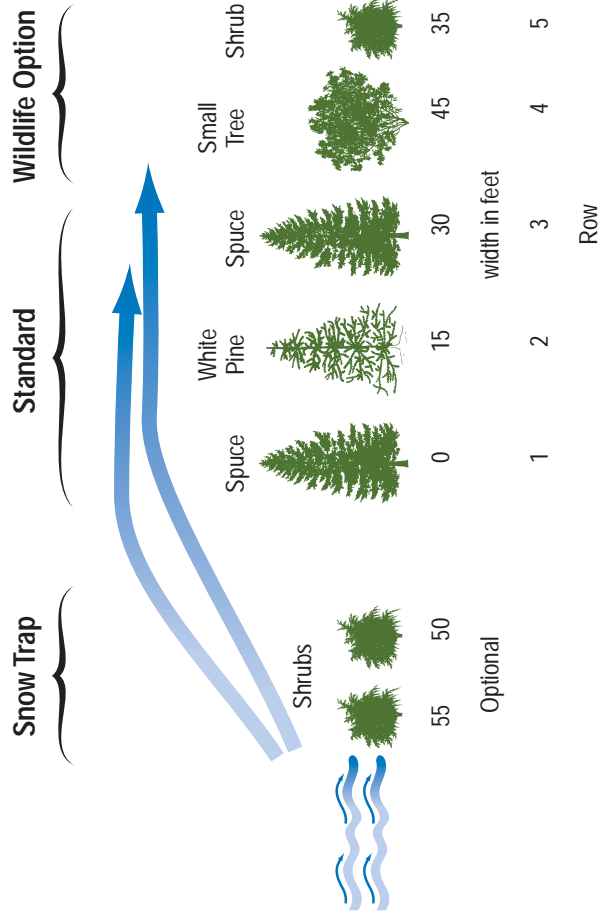


Figure 2

Cross-section of a standard 3-row windbreak with the addition of rows 4 and 5 as a wildlife option and an optional snow trap.



Site Preparation





The single most important part of establishing a windbreak that works is protecting the small bare-root seedlings from existing, competitive vegetation. This factor cannot be over emphasized. Not only do these plants compete for light and water, many grasses produce natural chemicals which suppress tree and shrub growth. **If you don't plan to do any site preparation, you should not bother planting a windbreak.** Heavy competition from weeds, grasses, and existing woody cover will choke out your planting in short order.

Mechanical Site Preparation

You can set back grass competition in a planting site with a heavy sod by rototilling, fall-plowing and/or discing in 6 foot wide strips leaving undisturbed sod between rows. By minimizing the amount of soil you disturb, you reduce the threat of soil erosion and weed seed invasion by such things as Canada thistle. Spring plowing is discouraged as it will introduce air into the soil which can lead to desiccation (drying) of the roots of newly planted stock.

Chemical Site Preparation

Weedy or grassy competition can be controlled with selective herbicide use. Effective control depends on four factors:

-  timing of application
-  herbicide selected
-  weather conditions
-  application rate

Heavy sod can be controlled by a fall application of herbicide in the year prior to planting. Alternatively, a pre-emergent herbicide can be applied in the spring just after the trees are planted and before the existing grass cover has "greened up." Herbicides should not be allowed to come in contact with the tree roots.

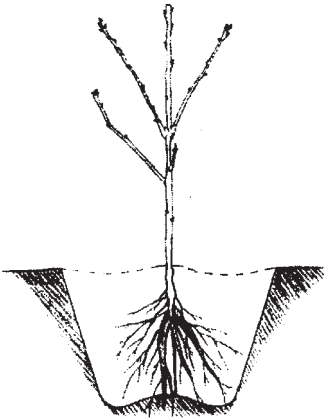
Very dry conditions will limit the effectiveness of most herbicides. Be sure to follow label directions for application rates, as rates differ depending on soil type and herbicide. Consult with your local DNR forester for specific herbicide recommendations. **NOTE: All herbicides must be applied in accordance with label recommendations and their registered use.**

Good Planting Procedures

Care of Nursery Stock Prior to Planting

Once lifted and packaged at the nursery, bare-root seedlings are very perishable products. Extreme care is needed to avoid drying out the root system and overheating the seedlings prior to planting. Most windbreak packets are shipped in a sealed, 3-ply Kraft paper bag with a poly-coated liner. No root wrapping material is added. Therefore, a tear in the bag should be repaired immediately, as air entering the bag will dry out the roots quickly. Ideally, the bags of seedlings should be kept in a cooler at 34–38° F until planting. Otherwise, short-term storage in a cool cellar is acceptable.

It is not recommended that the seedlings be taken out of the bag and heeled in. The more you handle these bare-root seedlings, the more damage is done to the hair-like root structures. The bags can be opened to inspect the seedlings for temperature buildup or dryness. If a temperature buildup of 60° F or more is observed, the seedlings should be taken out of the bags, cooled with cold water, and placed back in the bags.



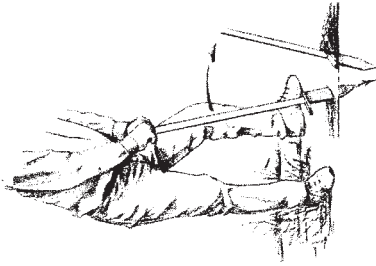
Slightly depress surface soil for water penetration. Pack soil, removing all air pockets. Use soil to help spread the roots.

Planting Time

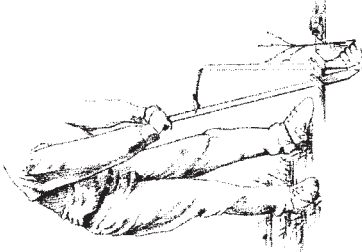
April is tree planting time in Wisconsin. Plant after the frost has left the ground, but before heavy bud break and shoot elongation (late May). Prior to planting, it is best to stake out the rows to keep the planters oriented and on line.

During planting, keep the roots moist. However, do not soak them in a bucket of water. A wet “gunny” sack laid over the roots in a tub or bucket is sufficient. In Wisconsin, tree planting machines are available (at a nominal rental fee) in most counties from the County Land Conservation Department or the DNR. These planters have a large plow-like shoe that penetrates the soil and forms a narrow trench. The roots are placed in the trench and as the trench closes, the tree is held firm by packing wheels. It usually takes a 40–50 h.p. tractor to pull these planters, plus a 3-person crew. The great advantage is that this system can plant 500–800 trees per hour. Hand planting can be accomplished using a spade, #2 round shovel, or planting bar. The planting hole should be deep enough to keep the roots from curling and the tree should be planted at the same depth as it was growing in the nursery (Figure 3 a & b). Pack the soil firmly so that there is no air space around the roots.

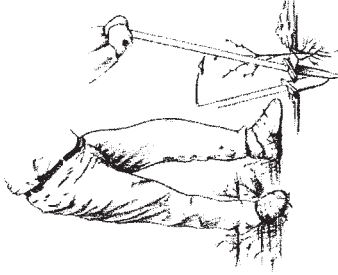
Figure 3. Hand Planting



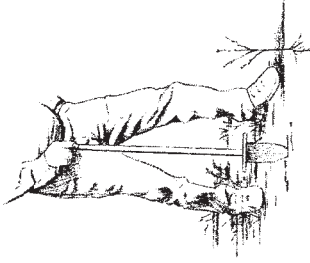
Insert planting bar at an angle, then push forward to an upright position.



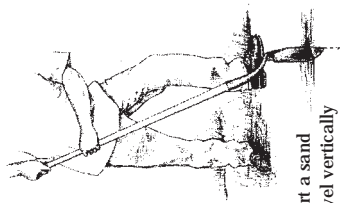
Place seedling at correct depth. Vertically insert bar 2" from seedling. Pull bar back, firming soil at bottom of hole.



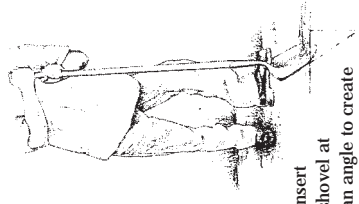
Push bar forward, firming the remainder of the hole.



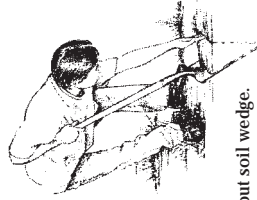
Fill remaining hole. Step on soil around seedling to firm.



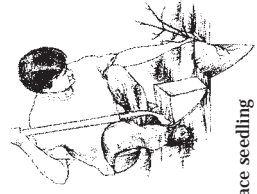
Insert a sand shovel vertically into soil.



Insert shovel at an angle to create a wedge of soil.



Lift out soil wedge.



Place seedling against vertical side of hole, replace soil wedge, then step on wedge to firm.

Long Term Maintenance

Like children, windbreaks require a little nurturing and maintenance in the early years. Protect your planting from livestock and fire. These young plants are especially attractive to cattle. Your investment of time and money is worth protecting with a fence.

Weed control in the first three years after establishment is very important. Within the first year, invading grasses and weeds can threaten a young windbreak. This weed control is best accomplished with herbicides, but cultivation, mowing, mulches, and hand weeding are all effective alternatives. The

reduction of heavy grass buildup around the plants reduces habitat for mice and voles.

Replace dead trees and shrubs every spring until you have 100 percent survival. Normally, replacement is made the following season and requires hand planting.

Newly planted windbreaks are subject to invasion by many undesirable species such as willow, box elder, elm, honeysuckle, and buckthorn. Hand removal in the seedling stage with a sharp grub hoe is the most efficient way to remove them.



Species Descriptions



Dogwoods

The dogwoods (Silky, Red-osier, and Gray) are native to Wisconsin and extremely winter hardy. All species spread from underground stolons and attain heights of 4–10 feet. Spring flowers typically bloom in May and produce white to blue berry-like fruit in August. It is heavily browsed by deer and a preferred food of turkey, grouse, etc. It is also an important cover plant for a variety of species. **Site Preference:** moist to well-drained soils in sun or shade although does its best in full sun.



Ninebark

Ninebark develops into a multi-stemmed, arching shrub about 10 feet tall at maturity. The bark peels into papery strips resembling “9s.” Numerous clusters of small white flowers in late May develop into brownish capsules in September. Ruffed grouse eat the buds and songbirds eat the small seeds. Ninebark makes excellent wildlife cover. **Site Preference:** one of the few shrubs that will grow on very droughty sites; is found on dry prairies to sedge meadows.



Hawthorn

Grows as a single-stemmed small tree, 20–24 feet tall, with laterally spreading thorny branches. Blossoming occurs prior to leaf-out in early May. Fruits start maturing in mid-August. Ruffed grouse and numerous songbirds are attracted to hawthorne trees for food and cover. **Site Preference:** prefers full sunlight, wide range of silt loams; avoid moist or wet sites as well as extremely droughty areas.



Wild Plum

Wild plum is a large shrub or small tree that frequently attains a height of 15 feet or more. It forms dense thickets, making it very valuable for bird nesting. Produces dense clusters of white flowers in May. One-inch globe-shaped red-orange to blue plums mature in August. American plum has spine-tipped twigs. **Site Preference:** grows best in full sunlight on a well-drained silt loam.



American Highbush Cranberry

A large shrub, 10–13 feet tall at maturity, with attractive white flower clusters in May producing bright orange-red fruits in September. The persistence of the fruit throughout the winter suggests it is not very palatable to most birds. However, the fact that it is persistent makes it a valuable emergency food source in severe winters. **Site Preference:** requires well-drained to moist sites for best development.



American Hazelnut

Hazelnut is a medium-sized shrub, 8–10 feet tall, that is common throughout Wisconsin. The nuts are enclosed in flat, ragged-appearing husks which mature in late summer. Hazelnuts are an excellent food source for deer, squirrel, chipmunks, blue jays, turkey, and grouse. **Site Preference:** grows well on a variety of soil types, including sandy soils; grows best in full sunlight.



Green Ash

Green ash is a small hardwood tree, growing 50–60 feet tall. The dark brown or gray bark is tinged with red; furrowed with flat, scaly ridges. The leaves are opposite and compound, 10"–12" long with 7–9 leaflets, each 3"–4" long. Leaves turn yellow in the fall. Its heavy seed crops (samaras borne in clusters) are the preferred food of wood ducks, cardinals, and grosbeaks. **Site Preference:** usually found along stream banks, on flood plains, and on wet upland sites, but will grow on dry upland sites.



Northern Red Oak

Red oak is a medium sized hardwood tree, growing 60–80 feet tall. The bark is nearly black with shallow furrows and wide, smooth, light gray ridges. The leaves are 5"–9" long with 7–11 sharply tipped lobes. Red oak is a moderately fast growing tree known for its high quality lumber and periodically abundant acorn crops. Red oak acorns are an excellent food source for deer, squirrel, turkey and a variety of wildlife. **Site Preference:** grows best on fertile, well-drained soils, but adapts to a variety of sites.



Red Pine

Red pine usually grows 60–80 feet tall. Red pine gets its name from the large reddish brown plates visible on the bark as the tree matures. The dark green needles are 4"–6" long in bundles of two. Cones are 2" long. Its seed is a favorite food of the pine siskin. Red pine does best in the northern $\frac{2}{3}$ of the state. **Site Preference:** thrives on light, acid, sandy soils, occasionally attaining large size on heavier soils.



Eastern White Pine

Native to Wisconsin, the majestic white pine can grow to 100 feet. Needles are 3"–5" long occurring in bundles of 5 which distinguish it from other native pines. Cones are 4"–6" long and mature in August or September of the second season. White pine is a frequent nest site of robins, mourning doves, and blue jays, among others. The rapid growth of white pine makes it ideal for wildlife cover. **Site Preference:** grows on sandy soils and rock ridges, but prefers fertile well-drained soils.



White Spruce

Native to northern Wisconsin, it produces short blue-green needles with sharp points. Cones are 2" long and fall soon after they ripen in autumn. Except in dense forests, the crown extends well down the trunk forming excellent escape cover for birds and mammals. **Site Preference:** prefers cool moist sites, especially around streams and lakes; do not plant on shallow, hot, south-facing slopes.



Northern White Cedar

White cedar is a compact, pyramid shaped tree reaching a height of 40–50 feet. The small, scale-like leaves are $\frac{1}{8}$ "– $\frac{1}{4}$ " long, yellowish to bright green, and appear to make the branches flat. Its thick branching pattern and dense foliage afford fine protective cover for birds and it is frequently used for nesting. It is a preferred food for deer. **Site Preference:** occurs on a variety of soils, doing well in moist soils, but actually growing more rapidly on well-drained sites.

For More Information

For additional information on the benefits of windbreaks and ordering seedlings, contact your local DNR forester, wildlife manager, or NRCS District Conservationist.

The Natural Resources Conservation Service (NRCS) can help you plan an effective windbreak for your farmstead or fields. NRCS provides technical assistance to private landowners at no charge.

The Farm Services Agency (FSA) may cost-share with agricultural producers on establishing windbreaks.

Most counties have access to mechanical tree planters through the county Land Conservation Department (LCD). The local DNR foresters usually coordinate the rental of the mechanical tree planters. Many LCDs also have tree and shrub seedling programs.

To find out how to get in touch with your local DNR forester, wildlife manager, or NRCS, contact:

**DNR, Division of Forestry or
Bureau of Wildlife Management**

Box 7921

Madison, WI 53707-7921

www.dnr.state.wi.us/org/land/forestry

www.dnr.state.wi.us/org/land/wildlife

NRCS

6515 Watts Road

Madison, WI 53719

www.nrcs.usda.gov/

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**Wisconsin Department of Natural Resources
Division of Forestry**