

EXTENSION NOTES



DESIGNING AND CARING FOR WINDBREAKS

Windbreaks perform a variety of jobs. They reduce soil erosion, increase crop yield and protect livestock. They shield buildings and help reduce heating costs. They can also add beauty to landscapes and provide habitat for wildlife. Getting the results you want from a windbreak can depend on factors as obvious as its location and size, or as subtle as the kind of trees you use and the spacing between them. One of the most important factors when designing a windbreak is knowing exactly what you want your windbreak to achieve.

This Extension Note provides information about designing and caring for windbreaks that perform different functions.

DESIGN FACTORS

Before you begin to design your windbreak, you should consider the following factors that determine how a windbreak works.

DENSITY

Density is the most important characteristic of a windbreak. It determines how much a windbreak slows the speed of the wind and the size of the area it shelters.

While density is defined as the amount of space in a windbreak through which air can travel, it is easily judged by the amount of light that can be seen through the leaves, twigs and branches along a windbreak's face. If light appears to be spread evenly throughout half of the face, the density is medium. If light can be seen through more or less than half of the face, its density is low or high.



A windbreak with medium density will protect the largest area of land. By reducing wind speed over the greatest distance, it can improve crop yield and quality, reduce soil erosion and provide shelter for buildings and greenhouses.

A high-density windbreak, where light can be seen through about 20 per cent of the face, acts more like a wall. Used in the wrong place it can create wind turbulence which can damage crops and erode soil. High density windbreaks should be used primarily to protect livestock from heat and cold, as well as to prevent snow from drifting on driveways or yards.

A low-density windbreak, where light can be seen through about 70 per cent of the face, is often used to spread snow evenly over crops and fields, thereby protecting crops, reducing soil erosion and improving the moisture content of the soil as the snow melts.

The density of a windbreak is determined, for the most part, by the species of trees.

HEIGHT

The height of a windbreak is governed by the species used, the growing conditions and the age of the trees. It influences the distance over which wind speeds are reduced. For example, a windbreak of medium density will reduce the wind speed by at least 20 per cent for a distance of 15 to 20 times the height of the windbreak. That means when a 50-kilometre-per-hour wind hits a 10-metre-high, medium-density windbreak, wind speed is reduced by at least 10 kilometres an hour for a distance of up to 200 metres. Although it may not sound like much, a wind speed reduction of this kind is enough to significantly decrease soil erosion and improve crop yield and quality. The area of greatest protection is found at a distance from the windbreak of eight to 10 times the height of the windbreak.

WIDTH

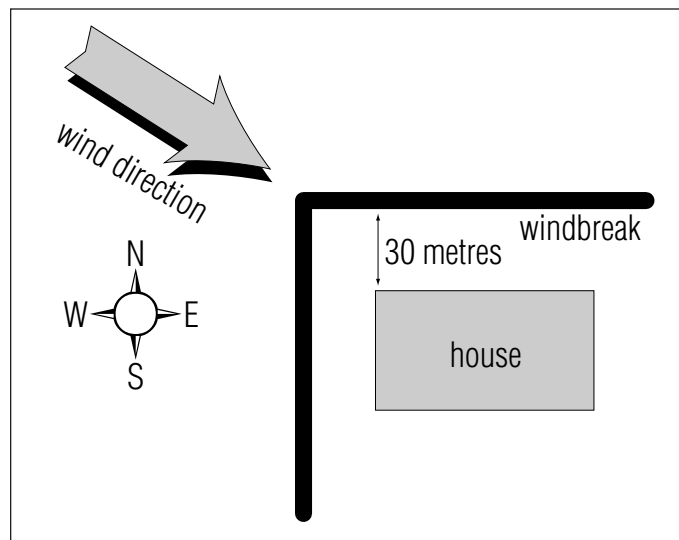
The width of a windbreak affects its density. As a general rule, the more rows of trees you plant, the higher the density of your windbreak. For most applications, a windbreak made from a single row of trees is sufficient and the required density can be achieved by selecting the correct tree species. In fact, for most species of conifers, more than a single row results in a very dense windbreak, which may not be appropriate for the objective you have in mind.

LENGTH

Because winds tend to bend in around the ends of a barrier, a windbreak should extend as far as possible beyond the area it is intended to shelter.

WINDBREAK DENSITY BY SPECIES		
SPECIES	DENSITY	
	SUMMER	WINTER
Norway Spruce	Medium	Medium
White Spruce	Medium	Medium
Blue Spruce	Medium to High	Medium to High
Austrian Pine	Low to Medium	Low to Medium
Scots Pine	Low to Medium	Low to Medium
Red Pine	Low to Medium	Low to Medium
White Cedar	Very High	Very High
Black Locust	Low to Medium	Very Low
Poplar*	Medium	Very Low
Silver Maple*	Medium	Low
Green Ash*	Medium	Low
Shrubs	Medium to High	Low to Medium

* hardwood shrubs, which are naturally pruned, should be planted at the base to fill in the bottom area.



Farmstead windbreaks provide the most protection when they are planted on the north and west sides and 20 to 30 metres from a building.

SPACING

To ensure that the trees in your windbreak develop and keep a full crown and remain healthy for a long time, they must be allowed to grow with as little competition from other plants as possible. The best way to achieve this is to plant the trees close together and to remove some of the trees as they mature. As a rule of thumb, plant trees about one metre apart along a row. This ensures that you have enough trees to allow for some natural mortality.

TREE SPECIES

Each tree and shrub species has its own characteristic height, density, width, growth rate and life expectancy. The species you choose, therefore, is an important factor in designing a windbreak to perform a particular function. When choosing a species, you will need to consider local soil and climatic conditions. Evergreens are the most common kind of tree used in windbreaks in Ontario, but deciduous trees are popular in other parts of the world.

SUITABILITY OF TREE SPECIES TO ONTARIO SOIL TYPES			
SURFACE TEXTURE	NATURAL DRAINAGE GOOD	FAIR (IMPERFECT)	POOR
Coarse (Sandy)	Austrian Pine Norway Spruce Red Pine White Spruce Black Locust White Cedar Windbreak Poplar	Norway Spruce Red Pine Austrian Pine White Cedar Windbreak Poplar Silver Maple Black Locust	Norway Spruce Silver Maple Green Ash White Cedar White Spruce
Medium (Coarse Loamy)	Norway Spruce Austrian Pine Red Pine White Cedar White Spruce Windbreak Poplar Black Locust	Norway Spruce Austrian Pine Red Pine White Cedar Windbreak Poplar Green Ash Silver Maple Black Locust	Silver Maple Green Ash Norway Spruce White Cedar White Spruce
Fine (Fine Loamy)	Norway Spruce White Spruce White Cedar Windbreak Poplar Green Ash Black Locust	Norway Spruce Silver Maple White Spruce Green Ash White Cedar Black Locust Windbreak Poplar	Silver Maple Green Ash Norway Spruce White Spruce
Very Fine (Clayey)	Norway Spruce White Spruce Green Ash Black Locust White Cedar	Green Ash Silver Maple Norway Spruce White Spruce Windbreak Poplar	Silver Maple Green Ash White Spruce
Note: for each texture-drainage combination, the most suitable species is listed first. The next most suitable is second and so on. White pine is not recommended for a single or two-row field windbreak but may be used in multiple-row windbreaks around farmsteads.			

Source: Best Management Practices Farm Forestry and Habitat Management

DESIGNING WINDBREAKS TO WORK FOR YOU

There are three main kinds of windbreaks, farmstead windbreaks that protect buildings, field windbreaks that protect crops and soils and living snow fences that protect roads by trapping drifting snow.

FARMSTEAD WINDBREAKS

Farmstead windbreaks protect homes, barns and greenhouses from wind, resulting in reduced heating costs and more comfortable living environments. The most effective farmstead windbreaks are of medium density. They protect buildings and their surrounding areas, while allowing some air to filter through to prevent the build-up of cold air in the spring and fall and to provide some air circulation in the summer. A single row of white spruce or Norway spruce has the ideal density for this purpose. To be most effective, the windbreak should be planted on the north and west sides of a house or barn, at a distance of about 30 metres from the building it is intended to protect.

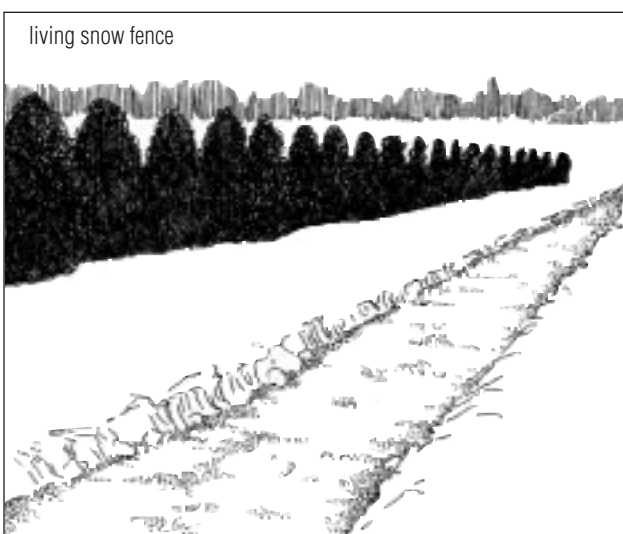
FIELD WINDBREAKS

Medium density windbreaks are most effective for controlling erosion and protecting crops. As with farmstead windbreaks, a single row of spruce or pine planted at least on the north and west sides of the field is best. Planting on all sides gives even greater protection.

If, on the other hand, you want to ensure that snow is distributed evenly over your fields, a single row of hardwoods is best. This type of windbreak also gives you good protection during the summer when the leaves are present. Silver maple, green ash and some poplars are among the hardwood species that should be considered. Remember that you should plant a row of shrubs along with the hardwood trees to fill in the gaps that will occur as the trees get bigger and lose their bottom branches. Highbush cranberry, nannyberry, ninebark or alternate-leaved dogwood are good shrub species to consider. These should be planted in a row parallel to the windbreak at a distance of about three metres from the windbreak on the upwind side.

LIVING SNOW FENCES

High density windbreaks are the best choices for trapping snow before it drifts onto lane ways or farmyards. A single row of white cedar or two rows of spruces (with three metres between the rows) makes a good snow fence. Most of the snow piles up within 10 to 15 metres of such a windbreak. Therefore, the trees should be planted about 20 metres from the nearest building, roadway or farmyard.



PLANTING AND CARING FOR WINDBREAKS

PLANTING

A windbreak is an important long-term investment. Careful site preparation the year before planting, the use of good planting stock and care in planting will ensure that you have an effective windbreak for a long time. For specific instructions on site preparation, the care of planting stock, planting techniques and weed control, please consult other Extension Notes in this series.

THINNING

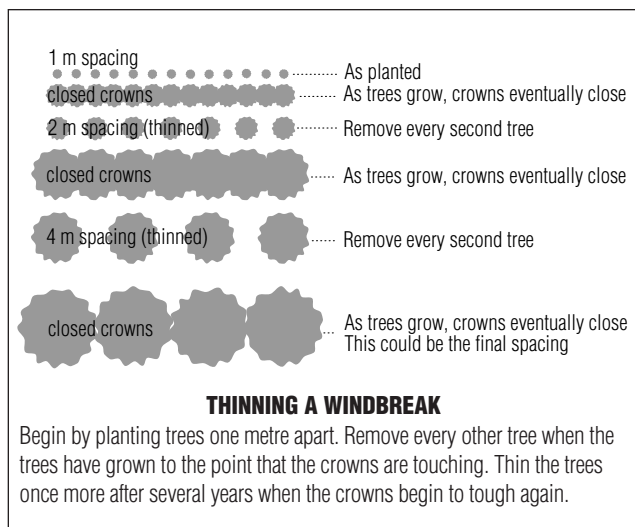
Thinning a windbreak is an essential part of its maintenance. After a number of years, the crowns of the trees will begin to touch. By removing every second tree, you'll be able to prevent the branches on the remaining trees from dying. After a number of years the crowns will again begin to touch. As before, remove every second tree, taking into consideration the trees lost through natural mortality and avoiding the creation of excessively large gaps. The key is to thin a windbreak before the lower branches on adjacent trees begin to die.

PLANTING AND REPLACEMENT

A field windbreak has to be continuous. If there are gaps in it, weather damage to crops and soil will increase in the areas behind the gaps. Replant the gaps left by dead trees as soon as possible.

Even the healthiest windbreak will not last forever. Make plans to replace your windbreak well in advance of its decline.

For more information on designing, planting and caring for a windbreak, contact a representative of your local conservation authority, Ontario Ministry of Agriculture, Food and Rural Affairs or Ministry of Natural Resources.



The high density of white cedar makes this species ideal as a living snow fence that traps snow in a deep narrow drift close to the windbreak.

NATIVE SHRUBS FOR WILDLIFE FOOD

NAME	SOILS/MOISTURE	GROWTH FORM	WILDLIFE USE
Highbush Cranberry	Fertile soil/well-drained	Tall shrub, two to four metres wet to moist sites (not dry)	Song/game birds use this, although mainly as winter nourishment
Red-osier Dogwood	Fertile soils/moist to wet sites	Small shrub, less than two metres, forms thickets	Song birds eat berries; rabbits, hare and deer browse twigs; cover for game birds
Alternate-leaved Dogwood	Most soils/moist best, tolerates dry	Shrub or small tree	Song/game birds, eat berries
Nannyberry	Moderately fertile/average to wet sites	Tall shrub, seven to ten metres	Many birds eat berries; rabbit and deer browse twigs; nesting
Elderberry	Well drained loam or sandy soil/well-drained to moist sites	Shrub, one to five metres	Song/game birds, red squirrels, chipmunks and mice eat berries; deer and rabbits browse
Staghorn Sumac	Can grow in very poor soil/well-drained to dry sites	Groups of shrubs, two to five metres	Song birds eat fruit; winter food for deer and rabbits
Serviceberry	Sandy loam/dry-average	Small tree, seven to thirteen metres	Many birds and mammals eat berries; deer browse twigs
Ninebark	Rich, well-drained/flood plain	Shrub, two to three metres	Many birds eat seeds
Wild Apple	Well-drained loam/clay loam/moist	Low spreading tree, eight metres	Deer, rabbits and grouse eat fruit; good for nesting
American Hazelnut	Most soils/well-drained	To three metres	Song/game birds and mammals eat nuts

Source: Best Management Practices Farm Forestry and Habitat Management

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